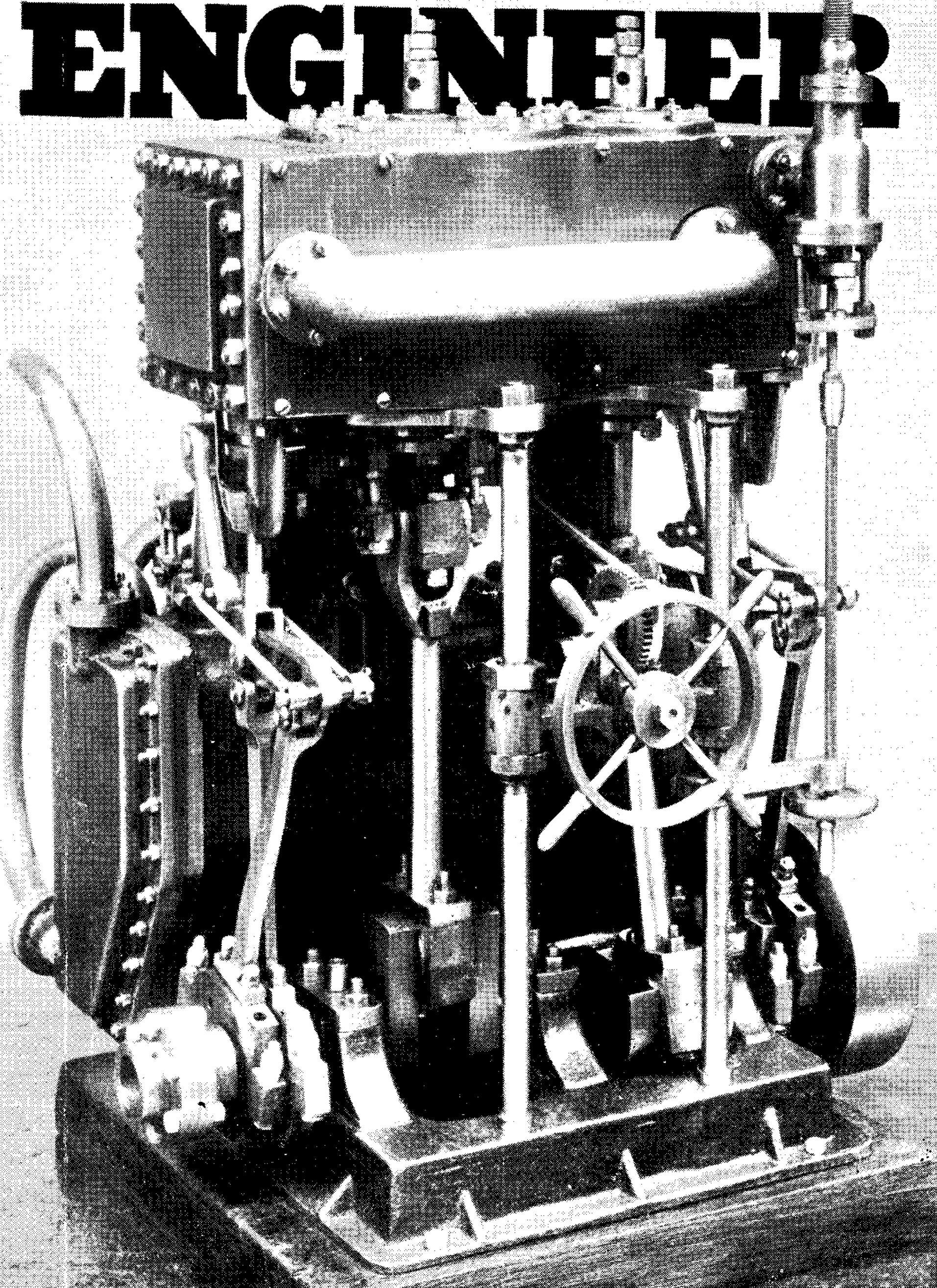
THE MODEL ENGINEER



Vol. 99 No. 2472 THURSDAY OCT 7 1948 9d.

The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, *GREAT QUEEN ST.*, *LONDON*, *W.C.2*

7TH OCTOBER 1948 VOL. 99 NO. 2472

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SMOKE RINGS

The Model Car Association

● A MEETING has been arranged for Sunday, October 17th, at 10.30 a.m., at the Bell Hotel, Humberstone Road, Leicester. This meeting will be for delegates from affiliated clubs only. Arrangements have been made for lunch, and it is hoped to finish the meeting by about 4.30 p.m. Readers requiring further information should write to the Hon. Secretary, Mr. G. E. Jackson, 1, Lime Grove, Chaddesden, Derby.—P.D.

M.E.T.A. Convention, 1948

● AN EXTREMELY successful convention, arranged by the Model Engineering Trade Association, was held at Royal Leamington Spa on September 7th-9th last. The proceedings had been well planned in advance and passed off without a hitch. The party, which included a number of ladies and special guests, received a warm welcome from The Worshipful the Mayor of Royal Leamington Spa, who, together with the Mayoress and the Town Clerk, Mr. J. N. Stothert, attended a dinner at the Marlborough Hotel.

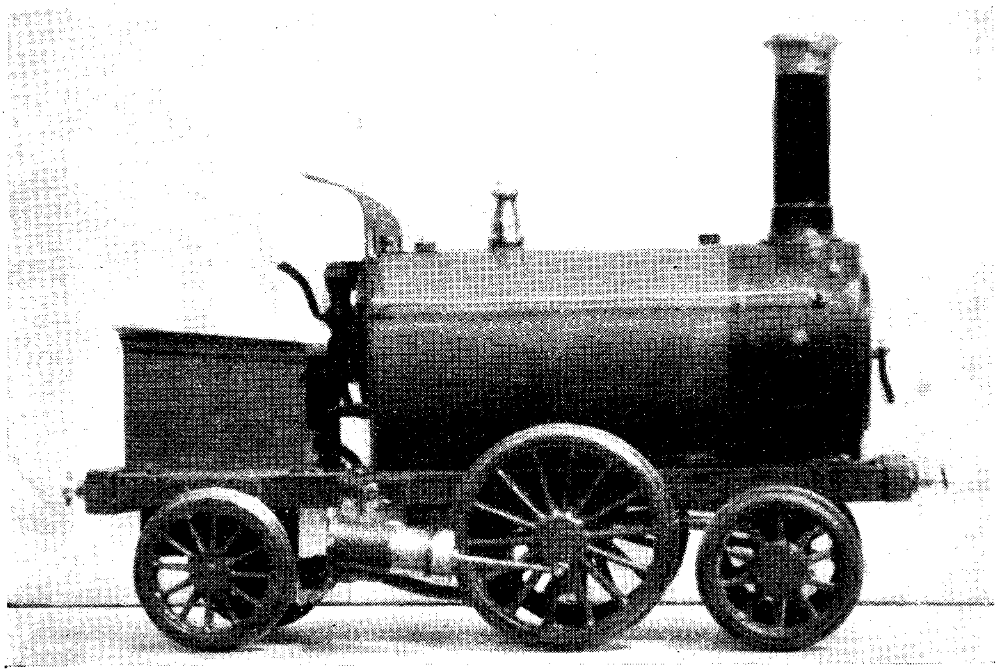
The following morning, the president, Mr. George Dow, formally opened the convention in the Council Chamber at the Town Hall. Subsequently, the chairman, Mr. R. J. Raymond, read a paper dealing with the structure, history, policy and future of the Association. Other contributions were : " A History of Modelling " by W. J. Bassett-Lowke ; " The Modeller's Point of View " by F. W. Chubb ; an open discussion on " Small Electric Mechanisms," conducted by A. S. Reidpath and J. G. Hefford ; " The Functions of the Wholesaler " by E. R. Gray ; " Scales and Gauges " by J. N. Maskelyne, and " The Retailer's Point of View " by J. G. Sandford.

The Association's guests were entertained by a visit to an excellent concert-party and by tours to Shakespeare's country and Warwick Castle. Mr. G. H. Lake, secretary of the Association, was warmly complimented for his efforts in organising a most useful and enjoyable three-day programme.—J.N.M.

Boring a Large Cylinder

● CYLINDER BORING problems are always a topic of great interest in THE MODEL ENGINEER, though, in most cases, the specific problems arise by reason of the small size of the bore to be machined. By way of a change, I have just had an interesting letter from a reader regarding the reboring of the two cylinders of a very large horizontal colliery engine. The cylinders are 43 in. bore by 84 in. stroke, and the method of reboring applied was to use a boring bar mounted in fixtures attached to the cylinder itself. Power was applied to the bar through a worm reduction

gear of about 50-1 ratio, driven by a small vertical engine of approximately 7 in. bore by 10 in. stroke. The boring bar was traversed by means of a longitudinal screw and star wheel, and it took several hours for a single traverse through the cylinder. This particular method of cylinder boring may be well known to readers who have had experience with very large engines, as it has been extensively applied, not only to the reboring of cylinders, but also the the initial boring of the cylinder blocks, both of the stationary and marine types, but there may be many readers who have never heard of it before. My correspondent enclosed a couple of very interesting photographs, showing the operations on the cylinders, but, unfortunately, they are not good enough for reproduction.—E.T.W.



An early Crebbin!

The "M.E." Exhibition Locomotive Track

● I WAS glad to see the passenger-carrying track this year restored to its accustomed place; in fact, there were actually two tracks, one the multi-gauge track loaned by the Society of Model and Experimental Engineers Affiliation and the other a 7¼-in. gauge track loaned by Fenlow Products Ltd., of Weybridge. Both were under the direct supervision of the S.M.E.E. Affiliation.

The locomotives were mostly old friends, though I noted three newcomers to the stud; one was a 5-in. gauge 2-6-2 tank engine based on the old Lynton and Barnstaple Railway's standard type but fitted with Baker valve-gear; then there was a brilliantly green, streamlined 4-6-2 engine, named *Flying Dutchman*, for 3½-in. gauge, finally, a neat 4-6-2 engine, for 7¼-in. gauge, which ran consistently well throughout the period of the show.

I am sorry that I did not get time to give as much attention as I should have liked to give to operations on the tracks; but on the few occasions when I could spare a moment or two to watching the running, I was glad to note that the old efficiency and happy spirit seemed to be much in evidence.

Incidentally, I understand that the weird and wonderful 3½-in. gauge 2-2-2 type engine, visible but not working, belongs to early Crebbin vintage.—J.N.M.

A Reader Blows Our Trumpet

● WE VERY rarely resort to recording readers' compliments on the contents and production of our journal, but on this occasion we cannot allow the following remarks from an Australian contributor to pass unpublished.

"I look forward to the infrequent arrival of the journal, and wish that a copy would arrive each week, as there is a feeling about it which impresses me and each week there are several articles which interest me. I think this is because the editorial staff have a sincere wish to meet the needs of the reader, rather than to increase the sales of the advertisers; while this policy continues, the true function of journalism is fulfilled.

"Wishing you a successful second fifty years of service to model engineers."

While such words as the above are written about us, we are greatly encouraged to carry on with the good work.—EDITORIAL STAFF.

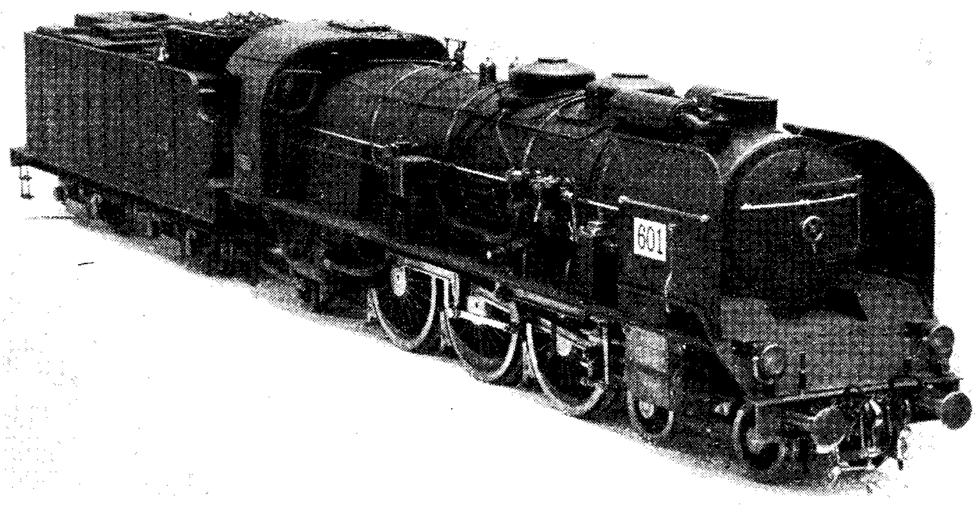
Comparisons are . . . . ?

Comments suggested by the presence of some miniature locomotives on the "International" stand at the "M.E." Exhibition

by J. N. MASKELYNE, A.I.Loco.E.

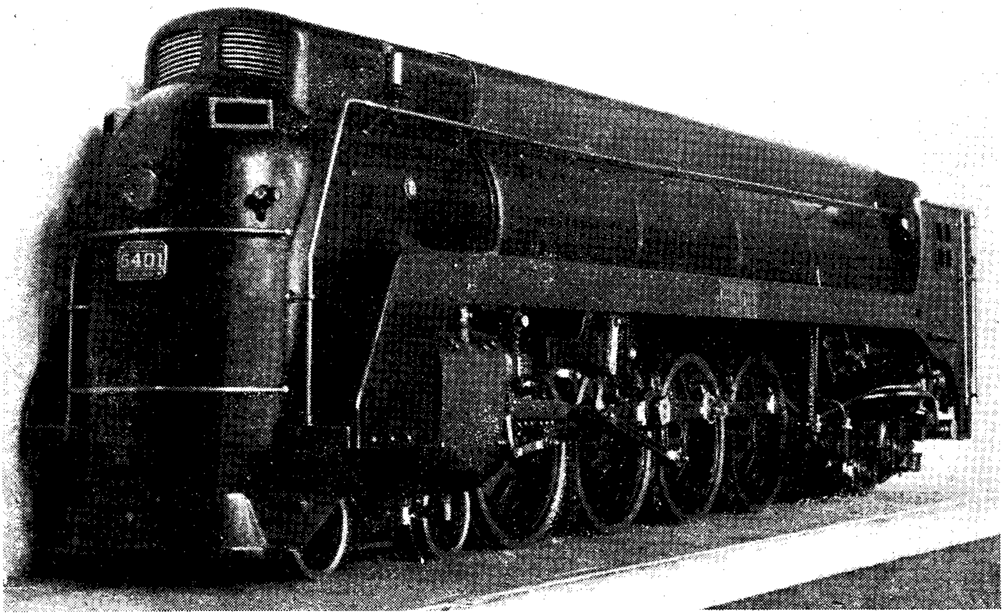
THE principal novelty at this year's "M.E." Exhibition was the "International" stand on which were to be found many models of all kinds sent from Scandinavia, France, Holland, Switzerland and Canada. Although I enjoyed the experience of examining all the models and admiring the unusual *finesse* of workmanship apparent in most of them, the following notes deal with the model locomotives only. Instinctively, I found myself comparing them with British work with which long association has made me thoroughly familiar. I found the comparison interesting, not to say instructive; but let me add that I was not merely looking for faults so that I could write a disparaging criticism of the work of our overseas friends! I was at once impressed by the fact that, if there were any faults, they were remarkably few, and this impression became stronger as my examination proceeded.

The two most striking locomotive models were: A 2½-in. gauge French National Railways (S.N.C.F.) Pacific built by M. André Forgues, of Paris, and a 3½-in. gauge Canadian National 4-8-4 type locomotive of the 6401 class. In each case, I was smitten by a feeling of sympathy for the builder who was faced with such a mass of complicated detail to reproduce! The French engine, in particular, is a veritable *tour de force* in this respect; yet M. Forgues had obviously attacked the problem fairly, squarely and bravely, bringing it to a most successful conclusion. Apparently, no detail had been forgotten; even a load of briquettes was piled on the tender, to supplement the normal meagre supply of coal. A great deal of the visible detail work was dummy; but to have omitted it would have spoiled the whole effect and detracted from the interest of a magnificent job.



The 2½-in. gauge French Pacific locomotive by M. Andre Forgues, of Paris

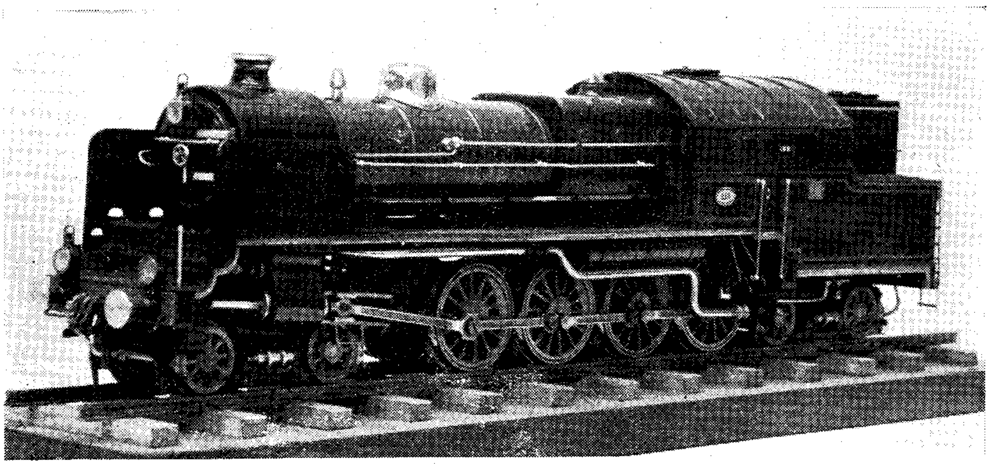
The Canadian engine, as yet without a tender, was in an entirely different category, so far as appearance is concerned, but just as interesting as the French engine. Mr. R. D. Wood, of Toronto, had taken as his prototype Engine No. 6401, used for hauling the Royal train in 1938; the model is meticulously accurate in all its visible features, and its construction has obviously involved an enormous amount of careful, painstaking work. It is the first large-scale working steam locomotive I have seen with wheel castings correctly reproducing the Box-Pok pattern. The semi-streamlined casing of the prototype was faithfully reproduced, giving ample evidence of Mr. Wood's ability to produce neat,



The $3\frac{1}{2}$-in. gauge Canadian National 4-8-4 *engine by Mr. R. D. Wood, of Toronto*

smooth plate-work of awkward shapes. Apart from slight damage sustained by the cab during transit from Canada, there was not a flaw to be detected. The painting had just the right amount of sheen, and I could name quite a few English builders of miniature locomotives who might have profited from an examination of Mr. Wood's paint-work! Yes, I am one of them, and I have learned a lesson!

Among the few electrically-driven miniature locomotives, was one that caught my particular attention; it came from Holland, and was an "O"-gauge 7-mm. scale Netherlands Railway 4-8-4 tank engine. This was a most outstanding piece of miniature work in which every visible detail of the fine prototype had been most carefully and accurately reduced to scale. For example, the sliding glazed shutters in the cab-sides were not only properly glazed but they actually slid, and without shaking; in other words, they had been really well fitted. Piping, plate-work, painting and finish on this engine were



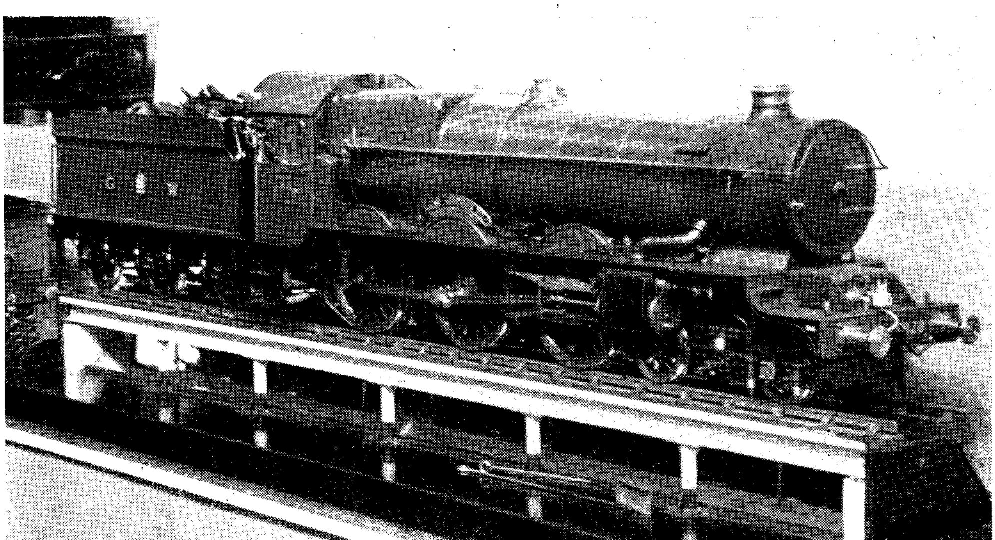
7-mm. scale Netherlands Railway 4-8-4 *passenger tank engine, electrically propelled, from Holland*

all so good that the discovery of the use of plain round-headed slotted screws as coupling-rod pins came as a terrific shock!

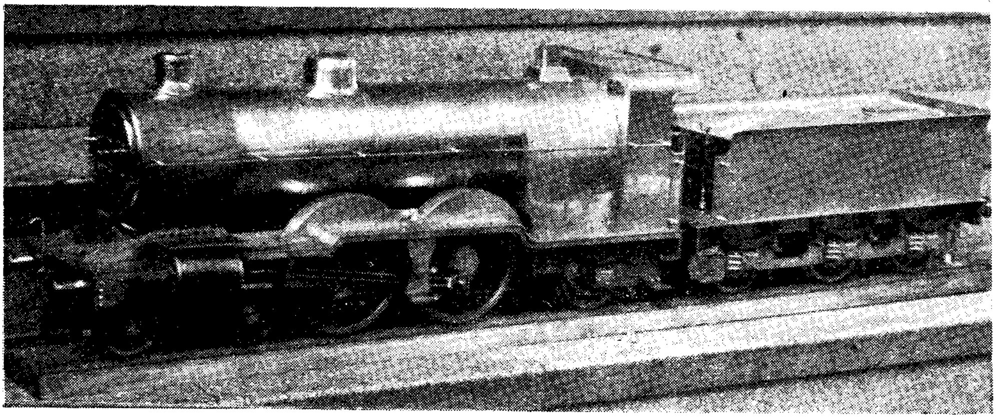
An "HO"-gauge 2-6-0 tender engine from Sweden was a very pretty little model, beautifully made and attractive to look at. It was Sweden, too, which was responsible for the smallest working electric locomotive in the exhibition. It was a 2-mm. scale 0-6-0 electric locomotive complete with working pantographs. A photograph is reproduced herewith.

Having mentioned some of the more striking of the locomotive models from overseas, I can only add that, when compared with British models, there is little to choose with regard to workmanship and general finish; the same faults are noticeable in both. I would say that, broadly speaking, overseas enthusiasts have more work to do than we have when correct representation of the prototype is desired. On the other hand, British locomotives are generally smaller than those in other countries, so that the overseas constructor of model steam locomotives, especially, gains a good deal in that his engine is larger than ours in the

An ultra-miniature working electric locomotive for 2-mm. scale, from Sweden



The 3½-in. gauge G.W.R. "King" by Mr. F. Cottam. Reflection from the light background has apparently had a bad effect upon the shape of the chimney

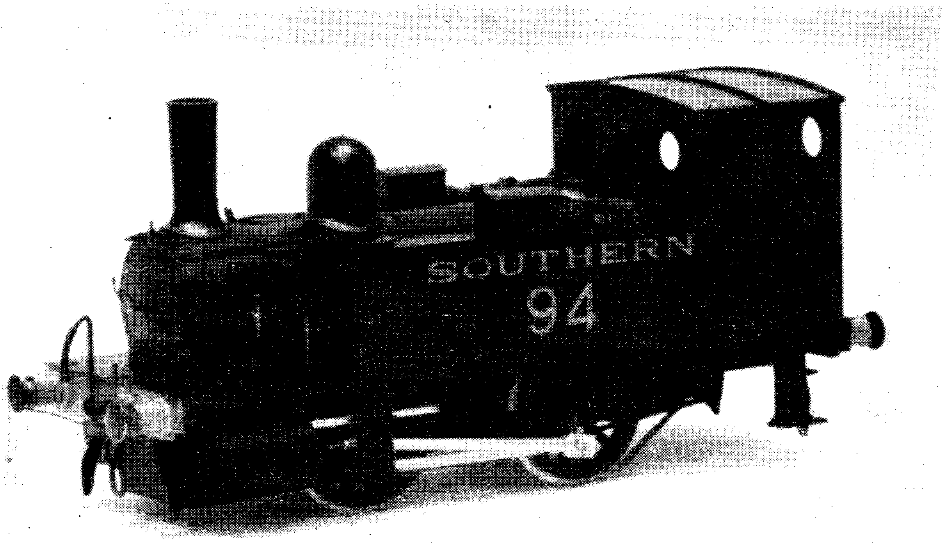


3½-in. gauge G.N.R. Atlantic locomotive by Mr. A. L. Clarke, of Horsham

same scale; therefore, he has less incentive to depart from scale reductions of prototype dimensions, and so he is more likely to produce good models without distortion, and more easily than we can.

As Mr. F. Cottam's G.W.R. "King" and Mr. R. D. Wood's Canadian 4-8-4 engine are both for 3½-in. gauge, I found myself almost subconsciously comparing the two directly. So far as the quality of the workmanship is concerned, I think these two engines were just about level; but a definite decision as to quantity of work would be difficult to decide. Both constructors had followed their respective prototypes as closely as the rather small scale would permit, though I am of the opinion that Mr. Cottam had applied more ingenuity to the details of his engine. For example, the *working* sight-feed lubricator on the "King" had obviously involved some considerable and careful experiment before a satisfactory result was obtained. I could not find a comparable detail on the Canadian engine. On the other hand, the paint-work on the latter was much superior to that on the English model; but against this, it was not so complicated!

After I had finished my examination of these overseas models, however, I realised that there was only one thing left for me to wish for: I would like to have got up steam in the French Pacific and the Canadian 4-8-4!

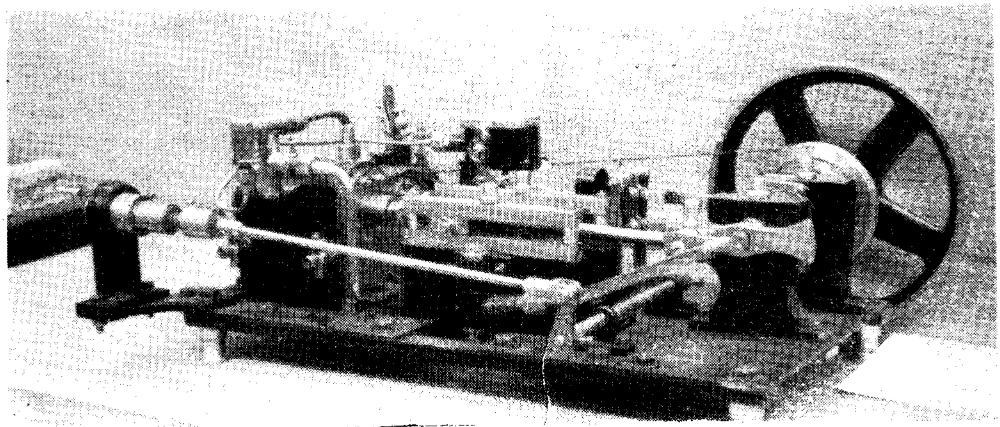


18-mm. gauge Southern B4 class Dock engine by Mr. C. T. Standfast, of Ilford

The Junior Exhibits

by Ian Bradley

THIS year, again, it fell to my lot to be on the panel of judges adjudicating in the Junior Class. As this is a class for any type of model or mechanical work, it is to be expected that there should be a wide diversity in the exhibits, a condition which contributes nothing in the way of relief to the difficulties of judging in the crowded atmosphere of the Horticultural Hall.



A model horizontal steam engine, the work of W. C. Crisp

Although the number of Junior entries was less than in the previous exhibition, the standard of workmanship, particularly amongst the first five prize-winners, was as high as ever, and it will be appreciated that these entrants ran each other very close when I say that only 40 marks separated the first and fifth competitors.

The winner was Mr. R. Edgar, of Peckham, who showed a beautifully finished model of the *Golden Hind* in all the glory of the decorated sails which were favoured in those days. Mr. Edgar is only 15 years old, and I am assured by "Jason" and the other judges in the Ship Models Section where this particular entry was on view that, though they did not actually have to judge this exhibit, so great was their interest in it they had to inspect the entry form several times to assure themselves that their eyesight had not deceived them in the matter of Mr. Edgar's age. It was little wonder that the actual judges found no difficulty in awarding the first prize to this excellent piece of work.

The winner of the second place was Mr. W. C. Crisp, of Flitwick, whose stationary horizontal steam engine, whilst embodying certain details not usually found on this type of plant, was a piece of mechanical work of unusual quality, the fitting and finish of which would not have disgraced senior exhibitors. Indeed, some of them might well learn a thing or two from this entry.

As Mr. Crisp is only 12 years old, he must really have been born with a spanner in his hand, for I cannot remember ever having seen so advanced a mechanical exhibit from so young a competitor. In addition to the diploma the judges felt that so signal an exhibit should be marked with the additional award of a monetary prize. In future exhibitions we shall expect to see some more work from the Crisp shops.

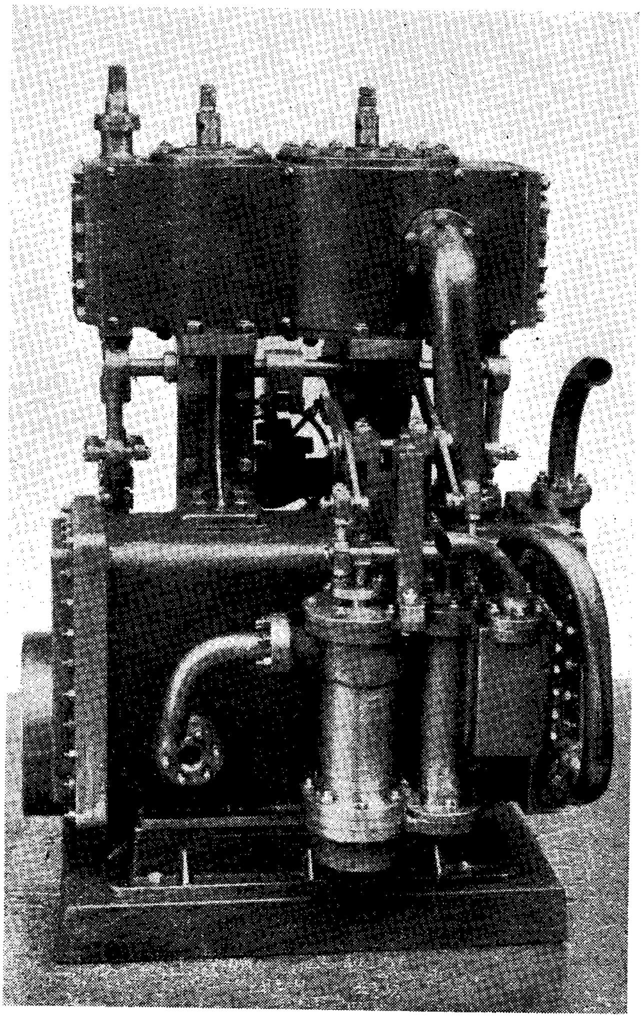
In third place came Mr. John Wallis, aged 14, who showed a model of a clinker-built rowing boat with oars, the whole made from balsa wood. The judges liked this exhibit very much, indeed, had this model been made from the correct woods as used in the prototype, it would have ranked very high indeed, for it was an extremely faithful reproduction of a longshore boat with its somewhat rough planking and brightly coloured paint. As it was, the judges did not hesitate to award a diploma and an additional money prize for a most meritorious effort.

The runners-up were Mr. M. B. Moulder, 16 years and 10 months, who showed a nicely finished model of a London Transport garage which gained a diploma, and Mr. C. J. Durham (15 years), whose seven model buses and one lorry were most realistic, in spite of being made to so small and exacting a scale. Here again, the judges awarded a diploma.

Whilst the other exhibits in this class did not reach the standard of those mentioned above, all were very creditable and the entrants may console themselves with the reflection that they showed nothing of which they need feel ashamed. Indeed, we would like to see more of their handiwork, for the larger the Junior Class becomes the greater will be the judges' pleasure, despite the difficulties in fairly assessing such widely varying exhibits, so let us have plenty of junior entries next year, for the more work there is to do in this class the better will the judges like it.

A Model Marine Engine

TWO excellent photographs, one of which is reproduced on the cover of this issue, and the other herewith, show a model compound condensing marine engine built up by Mr. Harrison Bacon, of Keswick, Cumberland.



The castings were obtained through advertising for them in THE MODEL ENGINEER, and the construction of the engine was begun in 1942. When the castings were examined, it was discovered that somebody had evidently started to machine the crankshaft, but had split it; so Mr. Bacon made a new one out of a piece of 3-in. mild-steel, the machining of which occupied 22 hours.

At an early stage, the problem of obtaining suitable studs and nuts appeared to be an insuperable one; Mr. Bacon had all but given up hope when, one day in Liverpool, he found and purchased a gross of 3/32-in. nuts and some lengths of silver-steel. Then the making of 3/32-in. and ⅛-in. studs was taken in hand; it proved to be very tedious, but was successfully completed. When the photographs were taken, the engine was still short of some ⅛-in. nuts; but all available material had been exhausted, and even some other models had been robbed!

Some of the smaller castings had to be scrapped, due to the hard skin on them making machining impossible. The crossheads, eccentrics and straps, pump rocker-gear and guides were all made out of a large old window-weight which proved to be a nice piece of stuff.

All machining was done on a home-made lathe which was built up on an old "Britannia" bed bought through an "M.E." advertisement. The crankshaft for this lathe, however, was turned on a 6-in. "IXL" lathe to which Mr. Bacon had access.

The model is certainly a handsome one and has been run several times, mostly on air. It does credit to its builder, who states that he is a lone hand in the Keswick area; nobody else in that part of the country seems to make models.

Mr. Bacon kindly offers to lend the drawings of this model to any interested readers, and is now looking for a design for a steam wagon.

It is a type of model that is not very often seen, though its possibilities would seem to be almost equal to those of a traction engine, especially if a fairly large scale is adopted.

To return to Mr. Bacon's marine engine, however, readers may be interested to know that the photograph of it reproduced on our cover this week was the winner of the Third Prize in our recent Photographic Competition. The round-headed screws are uncomfortably obtrusive, but, no doubt, they will be replaced by studs and nuts when the supply position permits! The photograph itself is a very good example of how a model should be photographed; the lighting is just right, and the exposure has brought out a satisfactory amount of detail in the deep shadows.

IN THE WORKSHOP

by "Duplex"

21—A Cutter-grinding Attachment

As it is essential that cutters such as counterbores, pin-drills and end-mills should have really sharp cutting edges if they are to do good work, some ready means of carrying out the sharpening operation will be a great advantage in the small workshop, where these tools are so often used. When these cutters are made in the workshop they should, therefore, be designed with a view to simplifying the grinding process as far as possible.

If, as is often the case, the commercial patterns of counterbores and pin-drills, described and illustrated in the article of January 15th, 1948, have more than four cutting lips, then a special form of grinding wheel will be required to resharpen them; and, again, the central fixed guide-pin in this and in other types of cutters will increase the difficulty of grinding the cutting edges along their whole length without, at the same time, damaging the central pin.

If, however, these tools are made with only two cutting lips, they can be readily ground on the flat side-face of the wheel with the aid of a simple jig which it is the purpose of this article to describe.

Now, the counterbore, like the twist drill and the D-bit, need cut only on its front cutting edges, which together are equal in length to the full diameter of the tool; moreover, when the cutter becomes worn, the full cutting diameter is restored by grinding the end-cutting lips, as in the case of the twist drill.

The end-mill, however, when traversed across the work, cuts on the sides of the cutting lips, as well as on their end faces.

The advantages of the two-lipped end-mill were mentioned in the article of January 15th, where also an easily-made cutter of this type was illustrated.

To increase the utility of our sharpening jig it should, therefore, be capable of grinding both the end and the side cutting edges of tools to enable end-mills as well as counterbores to be sharpened.

Before dealing with the construction of the grinding jig, it will be advisable to describe the method of making counterbores and end-mills of a simple pattern that can be conveniently sharpened with the aid of the jig in question.

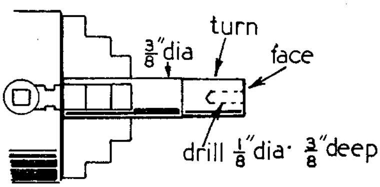


Fig. 1

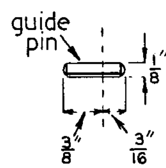


Fig. 2

Fig. 3

The Counterbore

For our own use we have been in the habit of making these cutters as required for any particular purpose, so that in time a number of sizes suitable for a wide range of work has been accumulated.

As was briefly outlined in article No. 18, the method used is to set a short length of silver-steel, as shown in Fig. 1, to run truly in the four-jaw chuck, and after facing the end, an axial hole is drilled from the tailstock as described in a previous article. This hole is formed to afford a good push fit for the silver-steel guide-pin, and it must be of sufficient depth to give the pin adequate support, say, some three times the diameter of the pin.

As shown in Fig. 2, an $\frac{1}{8}$-in. guide-pin is fitted in this instance, and, in general, the diameter of the pin should accord with the sizes of the pilot drills normally used; a 3/32-in. pin will serve for a $\frac{1}{4}$ in. diameter cutter and an $\frac{1}{8}$-in. pin for larger cutters up to about $\frac{3}{8}$ in. diameter, whilst a $\frac{3}{16}$-in. guide may be required for a cutter of $\frac{1}{2}$ in. diameter.

To save having to make a large number of cutters with different sizes of guide pins, the pilot hole should be drilled to fit the pin, and after the cutter has done its work this hole is opened out to the finished size.

Should there be any doubt as to the true setting of the work in the four-jaw chuck, or if the self-centring chuck is used to hold the rod, a light cut should be taken over surface to ensure that it is concentric with the bore formed to receive the guide-pin.

Where the cutter is used for spot-facing or shallow counterboring, clearance at the sides of the cutting edges will not be found necessary, but when deeper holes have to be counterbored it may be found an advantage to give relief behind the cutting edges; this can be readily done by making the end of the cutter slightly tapered so that, as shown in Fig. 3, its diameter decreases towards the shank. The machining is carried out by setting over the top slide of the

lathe to an angle of some ½ deg. or less from the parallel position.

The next operation is to form the cutting lips by first making a cut with a fine hacksaw across the centre, as illustrated in Fig. 4A and B, and it will be seen that the cut is made to slope downwards from the centre in order to give the necessary depth to the cutting lips without unduly reducing the support for the guide-pin. This results in the formation of two cutting edges, as shown at *X* and *Y* in Fig. 4A.

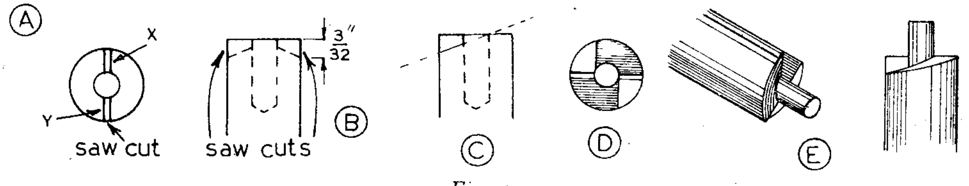


Fig. 4

The surplus metal is removed by making cuts with the hacksaw on opposite sides of the tip, as in Fig. 4C, and the appearance of the end of the cutter will then be shown in Fig. 4D.

The contours of the lips are next finished with a fine file to form a sharp cutting edge and, at the same time, the vertical faces of the lips are given a smooth finish with the edge of the file.

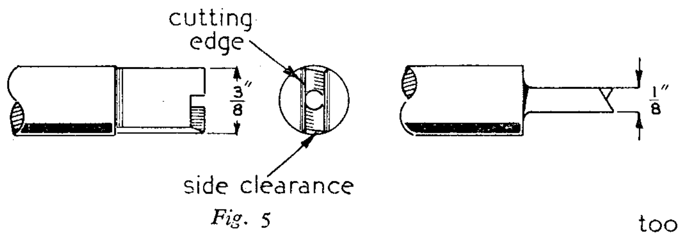


Fig. 5

Should a mistake be made, when filing, so as to upset the line of the cutting edge, the end of the cutter can be refaced in the lathe and the filing then continued. Cutters that have been carefully sharpened in this way will give good service, but as grinding the edges of the hardened cutter will, in any case, be necessary when resharpening is required, the final sharpening can, if preferred, be carried out later with the aid of the grinding jig.

The finished cutter with its guide-pin in place has the appearance shown in Fig. 4E.

After being formed to shape and prior to being ground, the cutter must be hardened by heating it to cherry-red and plunging it into cold water ; the surface is then cleaned with a piece of worn emerycloth and the tool is tempered by heating the shank until the straw colour formed reaches the cutting lips ; at this point, further tempering is arrested by again cooling the steel in water.

The End-mill

As in the previous example, the end-mill illustrated in Fig. 5 is formed from a short length of silver-steel faced and turned parallel while held in the chuck ; but, here, the central hole is drilled for a short distance only in order to separate but not to weaken the cutting lips. The lips are filed to the shape and dimensions illustrated, but care should be taken not to thin the lips unduly and thus risk breakage of the point when the cutter is in use.

As before, the cutter can be finished and sharpened by filing prior to hardening and tempering, but, if preferred, the grinding jig can be used for the final operation of sharpening both the end faces and the sides of the cutting lips to form the working clearance.

The Cutter-grinding Jig

The general arrangement of the jig when applied to the grinding machine is represented diagrammatically in Fig. 6. Reference to the subsequent drawings will show that the device consists essentially of two main components : the sliding carrier for holding and setting the cutter as shown in Fig. 7, and the adjustable bracket, Fig. 8, fitted with a tilting table on which the tool carrier slides to bring the point of the cutter into contact with the grinding wheel.

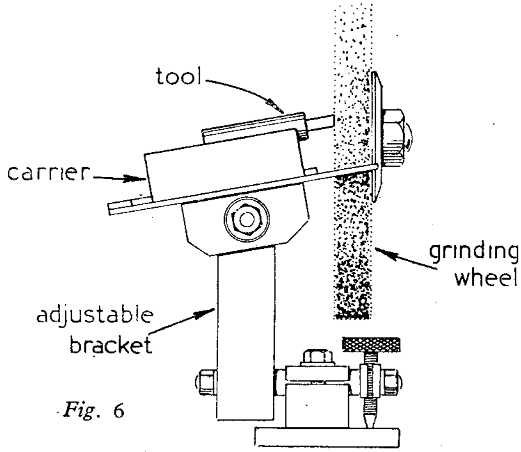
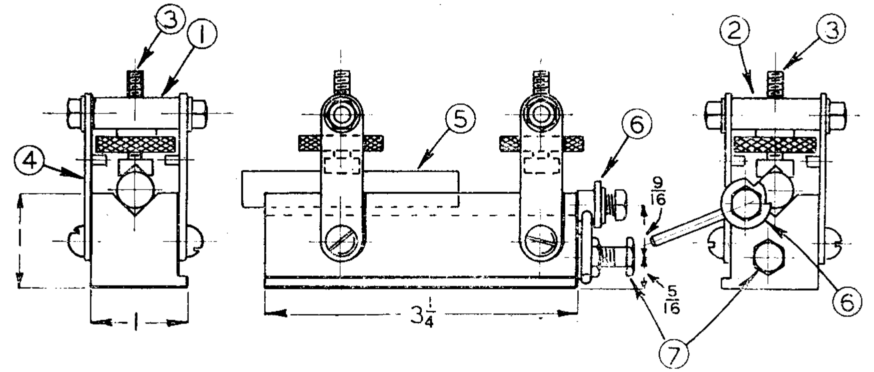


Fig. 6

As will be seen, the carrier is guided by a fence and no V-slide is fitted ; this is to enable the carrier to be readily removed for the purpose of resetting the cutter and, at the same time, to allow the table to be freed from any abrasive dust that may have collected during the grinding operation.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3 1/4

Fig. 7

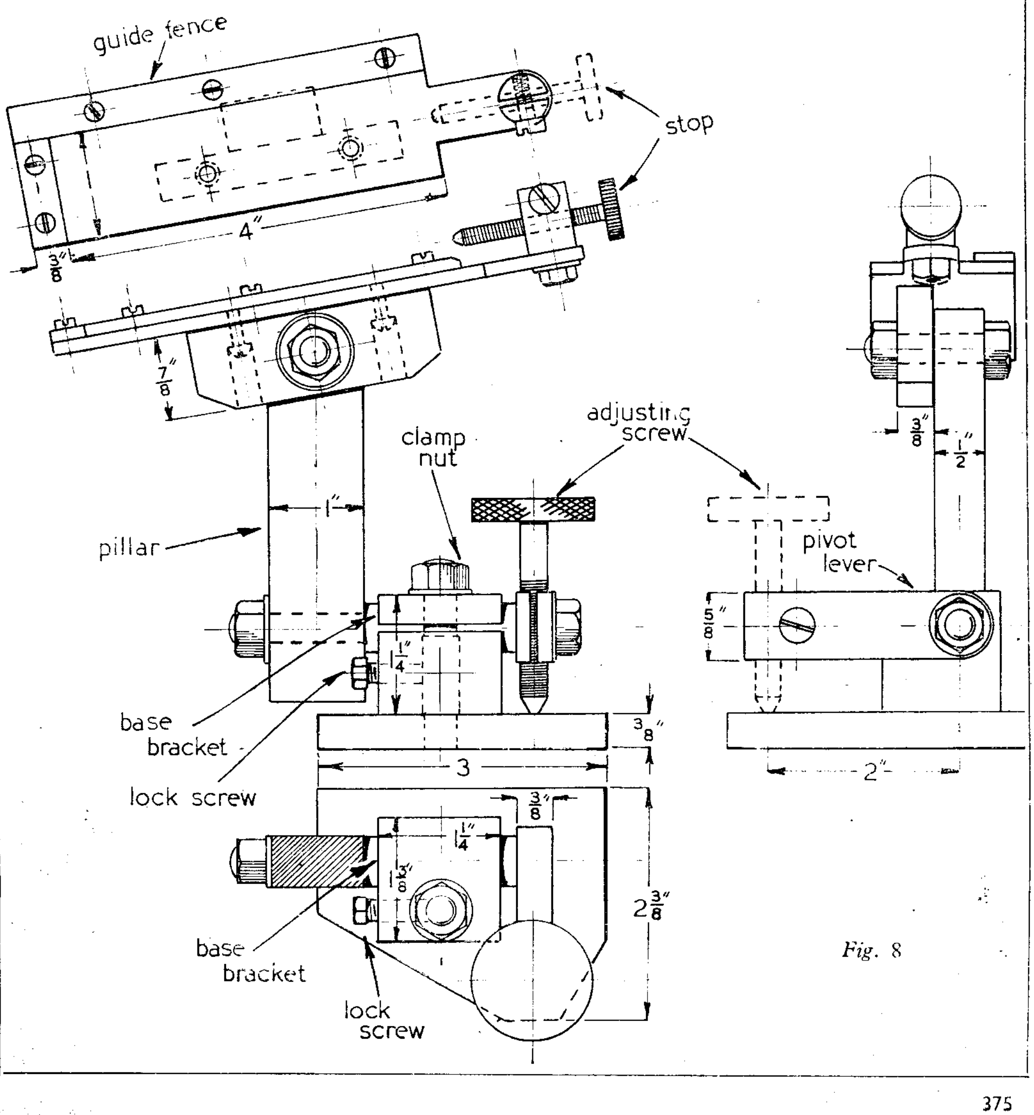

guide fence
stop
4"
3/8"
7/8"
clamp nut
adjusting screw
1"
pillar
pivot lever
3/8"
1/2"
5/8"
1 1/4"
base bracket
lock screw
3/8"
3
3/8"
1 1/4"
1 3/8"
2 3/8"
2"
base bracket
lock screw

Fig. 8

The table was, in the first place, made in accordance with Fig. 8, but later, to give easier operation, a lever-feed mechanism was fitted; this will be described, together with the details of its construction, in a continuation of this article.

An adjustable stop is fitted to the table to control the travel of the carrier when grinding either the end face or the side surfaces of the cutter.

The vertical pillar, carrying the table assembly, pivots in the base bracket, and this movement, which is controlled by means of the adjusting screw shown in the drawing, is used to set the feed when grinding the side faces of the cutter against the periphery of the wheel.

Constructing the Jig

Now that the working of the jig has been briefly dealt with, the actual construction of the device can be described in detail.

carries the clamping-screw for holding the cutter in position.

The lip gauge (6) serves, as in a twist-drill grinding jig, to index the lips of the cutter in the correct position for grinding; this gauge rotates on a hexagon-headed screw which is locked when the setting has been made. The notches in the gauge are filed to the proper shape by trying a cutter in position, and it may be found that more than one notch is required to position the lips of cutters of various sizes.

The adjustable set-screw (7) comes into contact with the table-top screw to limit the travel of the carrier and so set the amount ground off the end of the cutter equally on the two lips.

This screw is secured by means of a lock-nut, as shown in the drawing. The knurled finger-nuts fitted to the clamping-screws should be of large diameter to afford sufficient clamping pressure, but they must, of course, be kept clear of the side strips, which are fitted with pegs, as

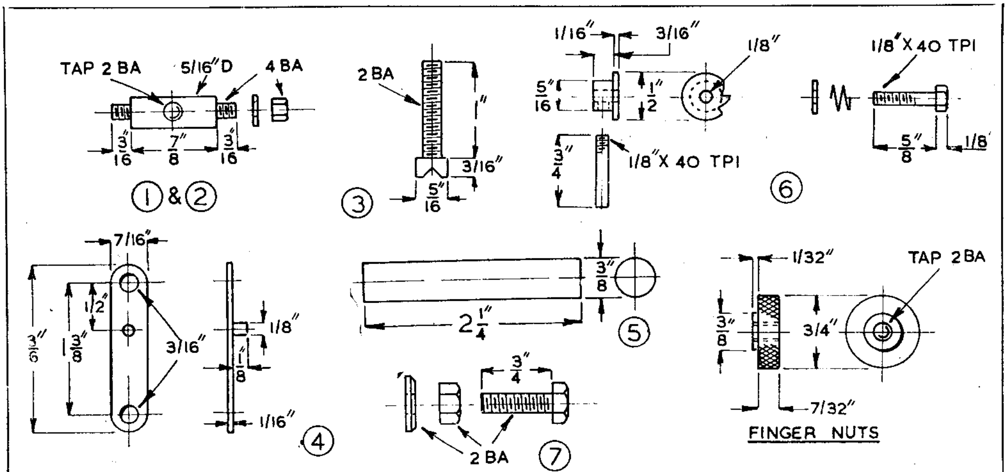


Fig. 9

The Carrier. This component, which is illustrated in Figs. 7 and 9, should be made first, so that the remaining parts of the jig can be adapted to suit as may be found necessary. The carrier block shown was made from the discarded V-jaw of a machine vice, and it is 1 in. broad at the sole, 1 in. high and $3\frac{1}{4}$ in. long.

If a suitable part is not available, the right-angled V can be formed in a length of 1 in. square mild-steel, either by milling or fly-cutting in the lathe, or by employing the shaping machine.

The block itself might well have, or be attached to, a broader base to give greater stability, and in any case, its under surface must be scraped flat to overcome any tendency to rock on the table. The two round bars (1 and 2) which carry the clamping-screws (3) with their knurled finger-nuts, are supported by the steel strips (4) secured to the block by means of 2-B.A. screws.

The bar (1) secures the cylindrical distance-piece (5), which acts as a stop when setting and resetting the cutter for grinding; the bar (2) shown, to prevent the clamping-screws falling during the insertion of the cutter in the jig. If preferred, hexagon nuts may be used instead of the knurled fittings.

The Table Assembly. The table itself, which is made from mild-steel strip $\frac{3}{16}$ in. or $\frac{1}{4}$ in. thick and $1\frac{1}{2}$ in. wide, is furnished with a guide fence at the rear and a stop fence at the left; both these are cut from $\frac{3}{8}$ in. $\times$ $\frac{1}{8}$ in. mild-steel, and the guide edge of the rear strip, as well as the surface of the table, is scraped true and flat. An extension of the table to the right carries the adjustable stop for determining the travel of the tool carrier; the body of the stop is turned from a length of $\frac{1}{2}$-in. round mild-steel and is cross-drilled and tapped $\frac{3}{16}$ in. $\times$ 40 t.p.i. to receive the adjusting screw, which is secured by means of a pinch-screw, as shown in the drawing. The height and position of the stop must be in accordance with the dimensions given for the carrier stop-screw in Fig. 7.

The table is fixed to the table bracket by means

of two or more 2-B.A. screws, which are sunk below the surface as shown, but, if preferred, a piece of angle material may be used for the bracket. A $\frac{5}{16}$ in. B.S.F. bolt forms the pivot clamp-bolt, and a snug should be fitted below the head to prevent the bolt from turning while adjustments are being made.

The vertical pillar is cut from a length of 1 in. $\times$ $\frac{1}{2}$ in. steel bar, and its length will depend on the centre height of the grinding-head above the bench, but in practice the centre of the cutter should be at approximately the centre of the grinding spindle when the table is set horizontally ; this will ensure that, when the table is tilted to an angle of 10 deg., the edges of the cutter being ground lie well above the wheel centre in order to facilitate the operation of grinding the side faces of the cutter, as will be described later.

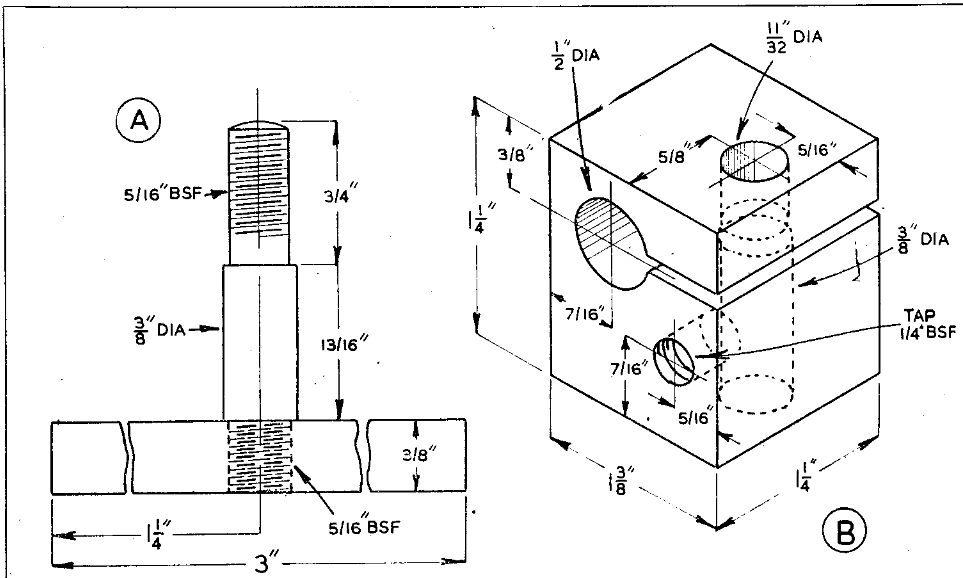


Fig. 10

A shouldered pivot shaft, $\frac{1}{2}$ in. in diameter, is secured to the lower end of the pillar, and the other end of this shaft is also shouldered for the attachment of the lever carrying the knurled adjusting-screw. The shouldered portions are formed $\frac{5}{16}$ in in diameter and threaded for the $\frac{5}{16}$ in. B.S.F. securing-nuts, as shown in the drawings.

The pivot lever, made from $\frac{5}{8}$ in. $\times$ $\frac{3}{8}$ in. mild-steel, is tapped $\frac{1}{4}$ in. $\times$ 40 t.p.i. to receive the adjusting-screw ; in addition, this end of the lever is slit and carries a pinch-screw to enable the adjusting-screw to be lightly clamped so that it turns somewhat stiffly and so maintains its setting.

The Base Bracket. The complete table unit is held in a bracket attached to the bench top or to the base-board on which the grinding-head is mounted. The construction of this bracket is similar to that supplied with the Potts drill grinding-jig, so that the various attachments used with the grinding machine can be changed at will. In this way, either the drill grinding-jig, the angular grinding-rest, or the cutter grinder can be quickly mounted in place and correctly adjusted to the grinding wheel.

Although the Potts bracket is machined from a casting, this component can readily be built up from standard material in the following manner. As shown in Fig. 10A, the base-piece is formed from a length of $\frac{3}{8}$ in. mild-steel, which carries a shouldered and threaded stud screwed into place and lightly riveted over at its lower end. The actual shape of the base and its leading dimensions are represented in Fig. 8.

The clamping block, Fig. 10B, is a mild-steel cube $1\frac{1}{4}$ in. in length and height, but $1\frac{3}{8}$ in. broad. It is drilled and reamed $\frac{1}{2}$ in. for the passage of the pivot shaft. To engage the pivot stud shown in Fig. 10A, it is drilled $\frac{3}{8}$ in. for a distance of $\frac{7}{8}$ in. from its lower face, and this is continued as an 11/32 in. hole to accommodate the reduced upper end of the stud. To allow the block to close on and grip the pivot shaft, it is slit from the front face as far as the $\frac{1}{2}$ in. diameter bore. For closing the block on the pivot shaft, either a $\frac{5}{16}$ in. B.S.F. nut and washer can be used or, if preferred, a cap-nut with a finger lever can be fitted.

When setting attachments so that their axis is parallel with that of the grinding spindle, the block is rotated about the stud shown in Fig. 10A and is then secured in position, irrespective of the clamping-nut, by means of the locking-screw shown in Fig. 8.

In a following article the construction of a lever-feed mechanism for operating the tool carrier will be dealt with, and also the method of using the device for grinding cutters of various types, will be fully described.

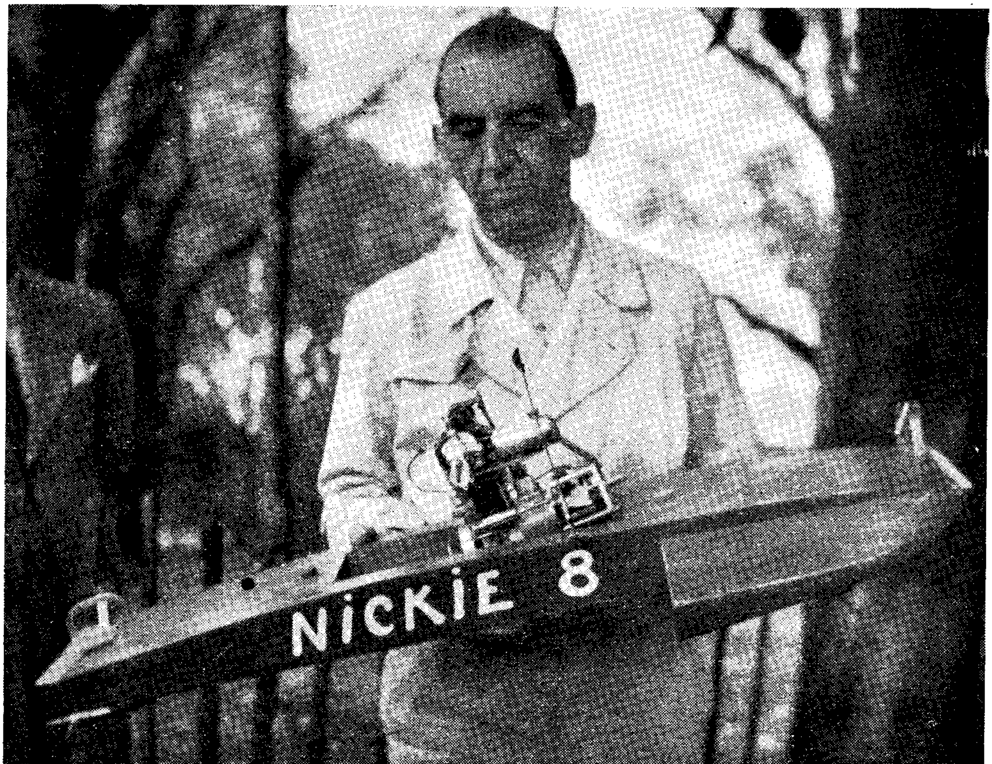
(*To be continued*)

The M.P.B.A. Grand Regatta

THE Grand Regatta of the Model Power Boat Association held Sunday, August 29th, brought forth a day of records—a record number of competitors and boats, a record attendance of spectators, and a new Class B record (subject to official recognitition) set up by Mr. Mitchell of the Runcorn Club.

Among the notable visitors to the regatta was one of the very early pioneers of model petrol engines, "Belvedere" Smith, now settled in some boats that had demonstrated on the circular track. Mr. Bells' fine tug *Neptune* was among the latter, as was the famous *Leda III* belonging to Mr. E. W. Vanner.

A spectacular run by Mr. A. Rayman's *Yvonne*, which stormed down the course in under 10 sec., gave the spectators a thrill. The first and second place winners both had only 0.2 sec. error. The third place was taken by Mr. W. Whiting's fine steam-yacht *Rose Marie*, with 1.4 sec. error.



Monsieur G. M. Suzor with his latest A class boat

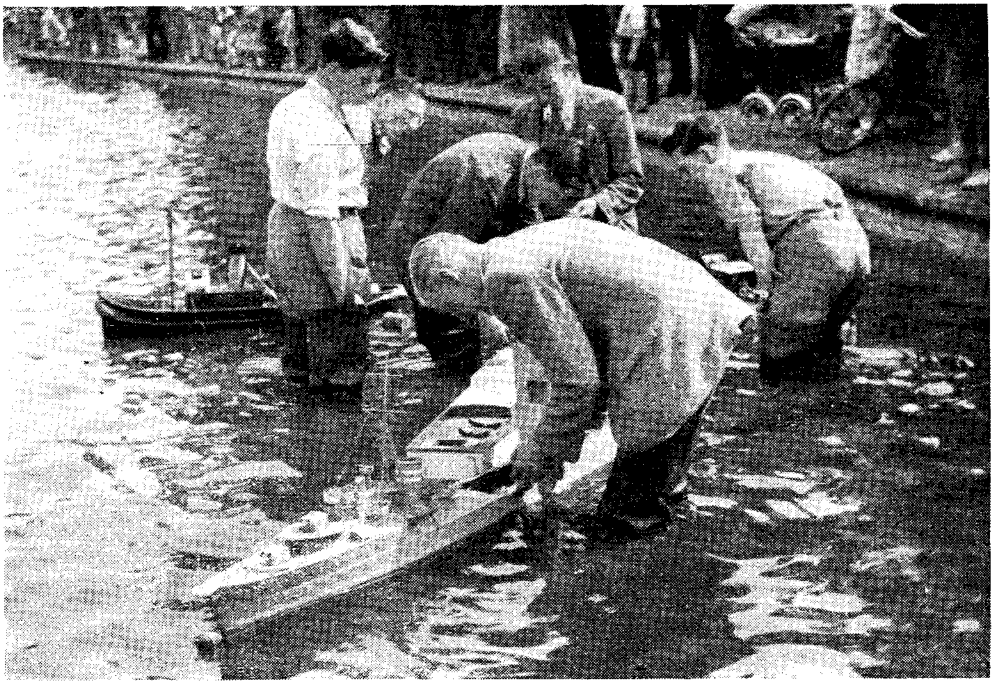
Australia and paying a visit to this country.

The weather turned out to be perfect, and by eleven o'clock crowds were already lining the pondside. The first boats to make an appearance were the prototype and straight-running craft competing in an 80 yd. nomination race. It would be impossible to describe all the 47 boats running in this event, but several craft deserve mention. Among the fine prototype boats competing in the event were two that had taken part in the competition section of THE MODEL ENGINEER Exhibition. Mr. Fidler's "Javelin" class destroyer and Mr. Roberts' steamer, also

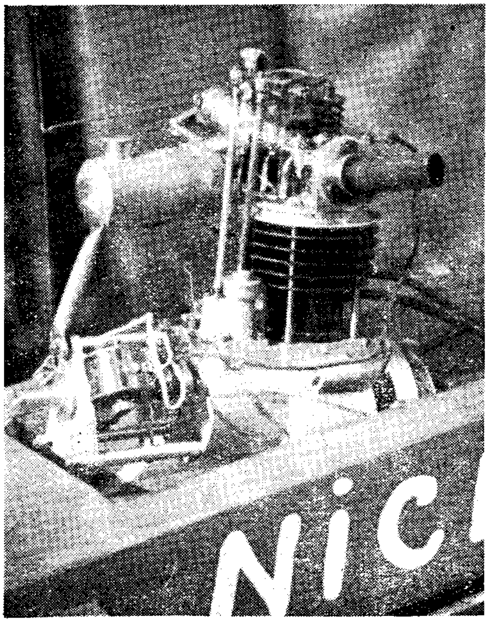
	Error
1st. Mr. Robinson (W. London)	
Elsie	0.2 sec.
2nd. Dr. Mechanik (W. London)	0.2 sec.
3rd. Mr. W. Whiting (Orpington)	
Rose Marie	1.4 sec.

Immediately following the nomination race, came the circular-course races for B and C class boats, the C class to run first.

Among the competitors in this event were M. Gems Suzor of Paris with *Mlle Sylla*, which has reached very high speeds recently, and Mr. A. Martin (Southampton) with his new boat



A group of competitors in the Nomination Race, showing Mr. Fidler's "Javelin" class destroyer in the foreground



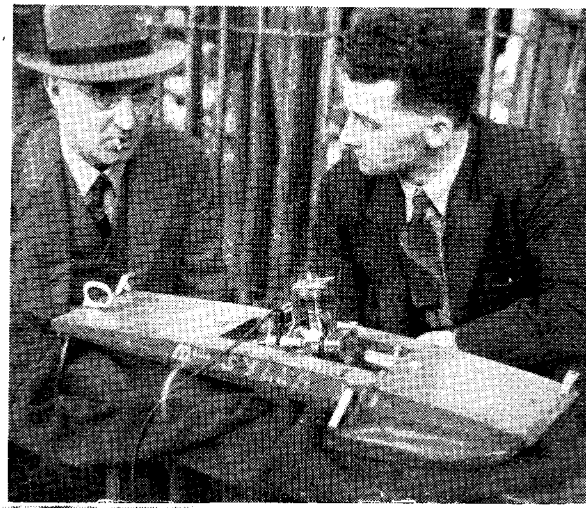
A close-up of the 30-c.c. four-stroke engine of M. Suzor's "Nickie 8"

Mr. Gregory, of the Victoria club, with his cruiser "Conquest"

Zephyr, which performed well at the Guildford regatta. Unfortunately, neither of these boats ran to form. M. Suzor's boat dived under on his first try, and although showing promise on the next attempt, failed to complete. Mr. J. Cruickshank's *Defiant III* ran well, recording over 31 m.p.h. for the 500 yd., and this remained unbeaten until M. Suzor managed to get in another run with his boat, just beating *Defiant III*s time by about 1 sec. Mr. Martin with his flash-steamer *Zephyr* showed promise, but could only complete one run, the engine slowing considerably on his second attempt, his speed for the first run being 26.4 m.p.h.

The result of the C class race (500 yd. for the Victory Cup) was thus :

	sec.	m.p.h.
1st. M. G. Suzor (Paris), *Mlle Sylla*	31.15	32.9
2nd. Mr. J. Cruickshank (Victoria), *Defiant III* ..	32.35	31.7



Above.—Messrs. W. Tomkinson, of Altrincham, and Gerry Buck, of Stoke-on-Trent, discuss M. Suzor's "Mlle Sylla"

Left.—Mr. Mitchell, of Runcorn, with his record-breaking B class boat "Beta"

It was now the turn of the B class, and in this event there were sensations !

The first competitor to go on the line was Mr. Mitchell (Runcorn) with *Beta*, and he succeeded in recording the fastest speed ever reached in a regatta or elsawhere, in this class, his time for the 500 yd. was 23 sec. dead, 44.5 m.p.h. !

Incidentally, *Beta* has had the addition of two false planes since appearing in the International, which lifts the hull sufficiently for the propeller to "surface." Mr. F. Jutton, who already is the acknowledged holder of the 300 yd. B class record—speed 43.9 m.p.h. with *Vesta II*, came on, and showed what flash steam could do, but could not quite beat Mr. Mitchell's boat. *Vesta II* ran well however, reaching over 41 m.p.h. The remaining boats were well below this speed.

Thus the result of the race (500 yd. for the Mears Trophy) :

	sec.	m.p.h.
1st. Mr. Mitchell (Runcorn) *Beta*	23	44.5
2nd. Mr. F. Jutton (Guildford) *Vesta II*	24.7	41.35
3rd. Mr. Dalziel (Bournville) *BV10*	36.15	28.41

Due to the heavy programme, the lunch interval had to be abandoned, and the next event was for the M.P.B.A. Steering Trophy. The same boats that had run in the nomination event were due to take part, and some excellent scoring was made.

Mr. Curtis with *Micky* (Victoria) scored 11 pts., but, running almost last, Messrs. Hood (Swindon) with *Truant* and B. Whiting *Joan* (Orpington), both scored 13 pts., and the re-run for first place resulted in a win for the Swindon boat. Result :

1st. Mr. Hood (Swindon) *Truant* 13 pts. + 1
2nd. Mr. B. Whiting (Orpington) *Joan* .. .. 13 pts. + 1
3rd. Mr. Curtis (Victoria) *Micky* 11 pts.

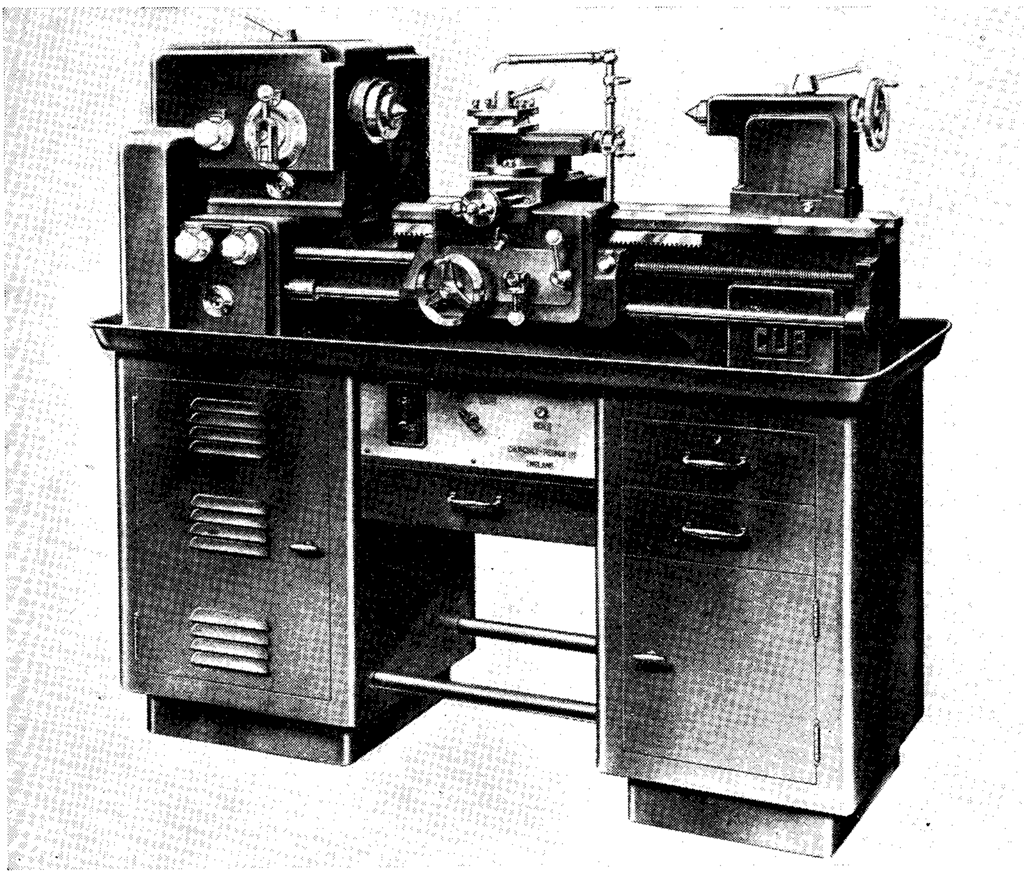
During this event, and in the nomination race earlier on, two independent judges, Mr. E. Bowness and Mr. C. L. Allen, had been judging the prototype competition, and finally awarded THE MODEL ENGINEER Cup to Mr. Maclellan's steam drifter *Lady Betty* (W. London). Mr. Fidler's "Javelin" class destroyer was the runner-up.

(*Continued on page* 384)

Models at the Machine Tool Exhibition

by C. G. Bainbridge, M.I.Mech.E.

ALTHOUGH the Machine Tool and Engineering Exhibition held at Olympia, London, from August 26th to September 11th, 1948, was primarily an exhibition of " big stuff," there was much to interest the model engineer and amateur craftsman. In fact, his own painstaking and laborious efforts, in his own humble workshop with a simple centre lathe, compared with the marvels of production and ease of operation of the automatics may well provide him with much food for thought for some time to come!



The Churchill-Redman " Cub " 6-in. centre lathe, twelve spindle speeds; speed can be changed without stopping machine; automatic lubrication; built-in motor and control gear.

Many developments in machine tools have, of course, taken place since the last exhibition in 1934, and the modern machine tool definitely has a " new look " compared with its predecessors. Motors, drives, gears and control equipment are built in and enclosed: controls are simplified and grouped; speeds and feeds are obtained by dial settings, and " finger-tip " and push-button control is the order of the day. As production is increased, the reduction of idle time becomes increasingly important, therefore power traverses, electric reversing, and electric or pneumatic control of chucks, tailstocks, and locks, are essential features of the machine intended for high-speed operation.

The almost general use of carbide tools has necessitated greater power, rigidity and durability in machine construction; many machines have hardened beds to eliminate wear, and it was noticed that vee-belts are very largely employed for built-in drives. Hydraulic operation of feed motions is now employed on many machines, and the ease and simplification of control so

obtained, together with the smooth and infinitely variable feed rate, makes this probably the most notable development, the Churchill all-hydraulic lathe being a typical example.

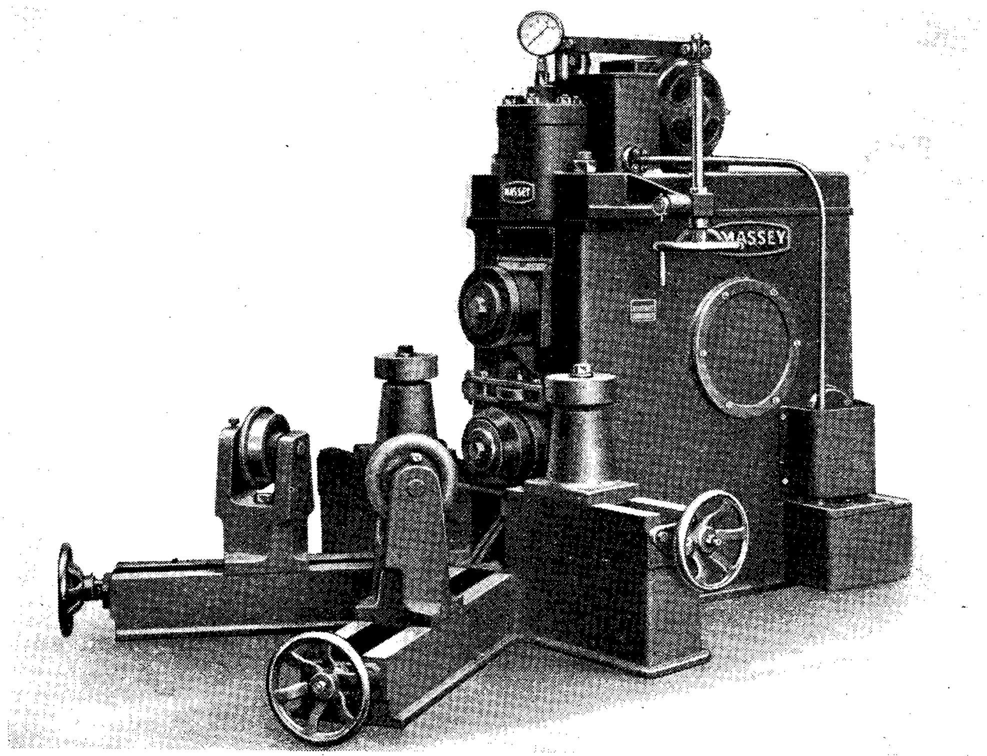
Another feature of this exhibition—and the one which will appeal especially to the model engineer—was the use made of models by manufacturers for those products which, for some reason could not be exhibited; in some cases the actual machine was too big, in others, operation could be more readily grasped by examining a model. For example, Messrs. Birlec Ltd. were showing a working model of a rotary continuous high-frequency induction heating furnace, which is now being built for heating billets at the rate of ten tons a day, before they are passed to the forging press.

The Igranic Electric Co. were demonstating the capabilities of one of their multipolar lifting magnets, by means of a $\frac{1}{8}$-in. scale model. These magnets are intended for lifting coils of steel strip in rolling mills, and the design is such that coils laying adjacent to each other can be picked up individually without difficulty. Incidentally, the model magnet is handled by a model telpher crane.

Messrs. George Ellison were able to show, by practical demonstration on a large scale working model, the operation of their automatic overload release mechanism on "Ellison" electric motor starters.

There were four interesting models of Massey drop forging and smithy equipment, which is too large for exhibition.

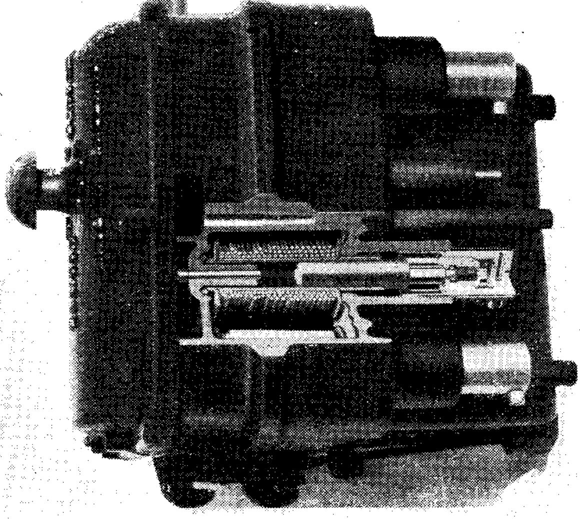
Another aspect of the use of models was employed to advantage by Messrs. Samuel Osborne & Co. Ltd., in a gallery stand which did not permit the use of heavy machine tools for demonstrating their cutting tools; therefore, the central feature of the stand comprised a series of panel models showing how their tool steels are produced. The first model showed an arc furnace melting shop, where the steel is melted and cast into ingots; the second was a working model showing the forging of the ingots into blooms, and the third panel showed a train of rolls for rolling the blooms into bars.



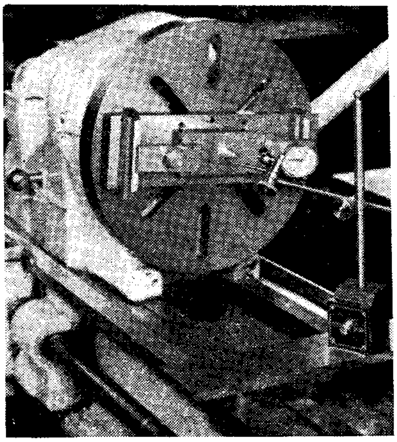
Tyre fixing rolls; the rolling on of tyres now supersedes power hammering. This machine, built by B. & S. Massey Ltd., was represented by a working model

Associated British Machine Tool Makers were showing some excellent models of historic interest. There was one of Wilkinson's boring mill which made Watt's steam engines a commercial success (*circa* 1785); others showed the series of machines installed in Portsmouth Dockyard by Brunel for the mass-production of wood pulley-blocks and their sheaves at the time of the Napoleonic invasion scare.

There were also some excellent display (i.e. not scale) models on other stands, showing

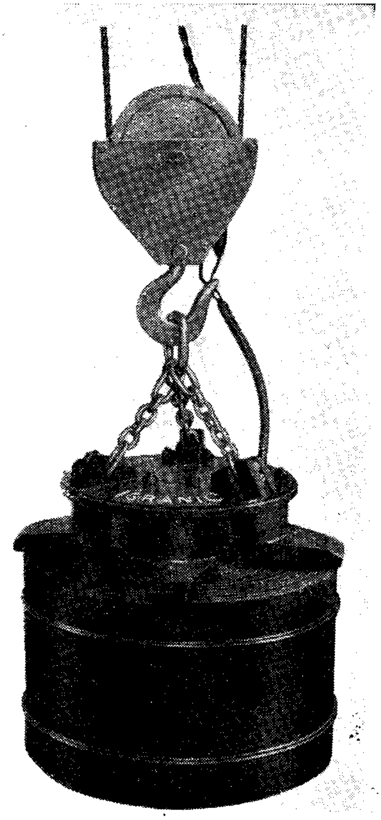


A large scale model of the Ellison "Bantam" direct-on starter, cut away to show the mechanism of the solenoid over-load release and the triple-action time lag

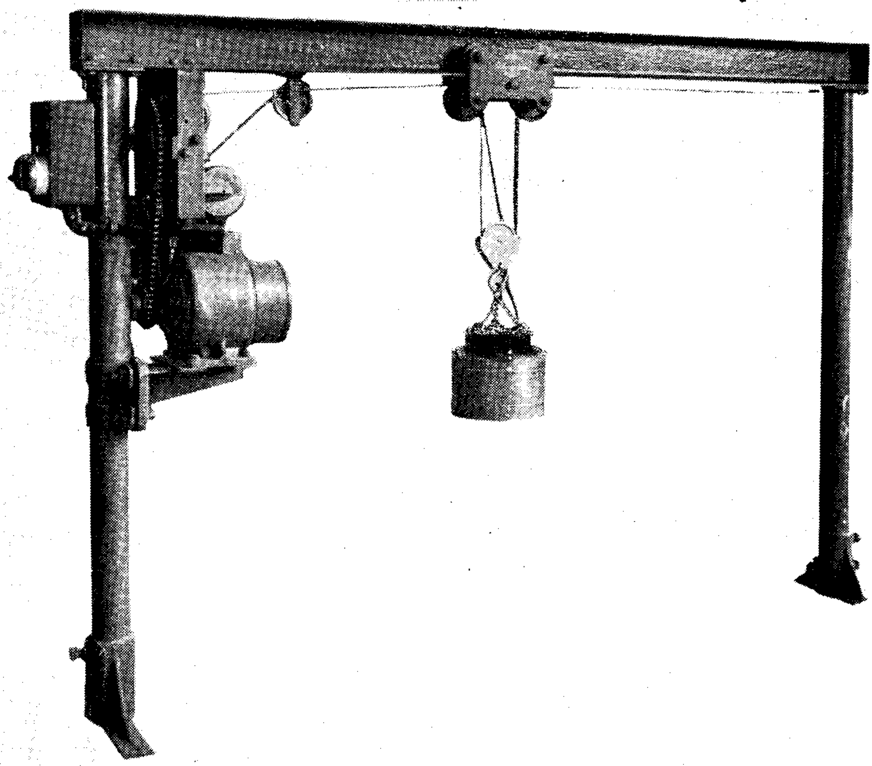


The "Eclipse" magnetic base for dial gauge indicator or scribing block. Magnetic on base and both sides; magnetism can be switched "on" or "off" by push-button. (James Neill & Co. (Sheffield) Ltd.)

Model of Birlec high-frequency heating furnace for heating steel billets



One-eighth scale working model of multi-polar lifting magnet, shown lifting coil of steel strip. (Igranic Electric Co. Ltd.)



This structure and control gear, although not strictly to scale, represents a telpher crane and enables the handling of the multipolar lifting magnet to be effectively demonstrated. (Igranic Electric Co. Ltd.)

production methods, equipment, operation and finished productions.

Finally, there was a tempting array of small tools, lathe accessories, and "gadgets," while for the experimentally minded, the National Physical Laboratory had a most interesting stand showing the methods employed for research into the accuracy and performance factors of drilling, lathe work, and other production engineering processes.

The M.P.B.A. Grand Regatta

(*Continued from page* 380)

The final event was the Speed Championship Race for class A Hydroplanes, again over 500 yd., and some good performances were seen, although not quite up to anticipation, as the reputation of M. Suzor's *Nickie* 8 is high, as is Mr. K. G. Williams *Faro* (Bournville), for which a new record is claimed of over 50 m.p.h. (made recently at Bournville).

Mr. B. Miles (Malden), who had hoped to run his new boat fitted with a supercharged twin four-stroke, had the misfortune to break a rocker while "tuning up" in the enclosure, thus putting him out of the running.

Another very interesting boat was Mr. Clifford's (of Chatterbox fame) new surface propeller job *Ee-Bah-Gum*, and this boat ran very well.

M. Suzor's *Nickie* 8 seems to have the same proclivities as *Mlle Sylla*, i.e. diving under, while apparently planing excellently otherwise. *Nickie* 8 recorded a speed of about 35.7 m.p.h. Mr. K. G. Williams put up the best speed in this race. Result :

	sec.	m.p.h.
1st. Mr. K. G. Williams (Bournville) *Faro* ..	24.95	41.2
2nd. Mr. Pilliner (Southampton) *Ginger*	28	36.5
3rd. Mr. Clifford (Victoria) *Ee-Bah-Gum*	28.27	36

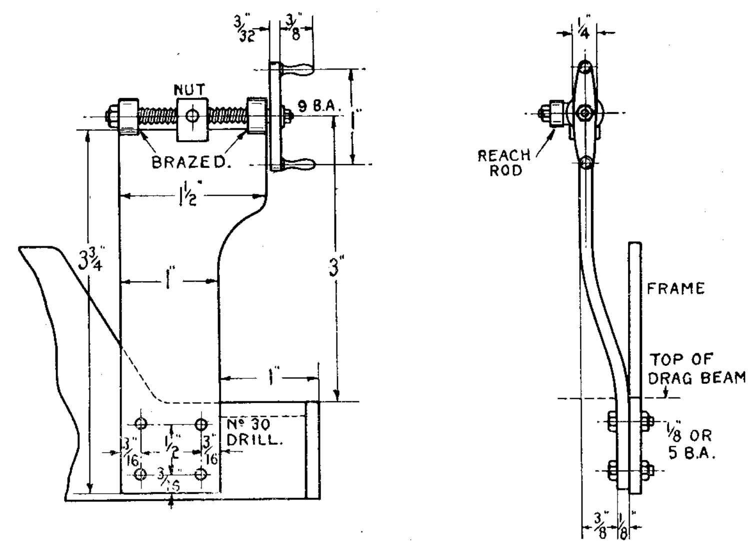
The Crebbin Trophy went to Mr. Jutton (Guildford), for his speed of 41.35 m.p.h., and the Wembley Trophy was held over, as there were no competitors who could be considered as "beginners."

The special prize for the best silenced hydroplane went to Mr. Mitchell (Runcorn), whose boat *Beta* was excellently silenced.

A 3½-in. Gauge L.M.S. Class 5 Loco.

by "L.B.S.C."

I'M going to tell you right away, that the screw reversing-gear I am specifying for "Doris" is *not* a copy of the kind used on her big sisters, and shouldn't be at all surprised if that fact causes Inspector Meticulous to hie him to the local hostelry and drown his sorrows in a pint of the best (jolly good excuse, anyway !) ; but, as usual, there is "method in my madness." On the big Class 5's, the driver rides on the footplate ; and to keep him well under cover, and have everything nice and handy, Sir W. A. Stanier put the reverser up in the corner of the cab. Drivers of 3½-in. gauge Class 5's have to perform under open-air treatment, and the relationship of their fingers and the boiler isn't exactly "to scale." On top of that, the little boiler gets as hot as the big one (again, you can't "scale" Nature) and the amount of feeling in the fingers of a driver of 3½-in. gauge engines is exactly the same as in those of the 4 ft. 8½-in. gauge driver ; in fact, maybe a bit more so, as the former isn't "hardened." I reckon my fingers have asbestos skin ! However, to make the reverser more get-at-able, I have brought it back to the edge of the cab ; and to save the complication of a box casting and other attachments, I have substituted a simple stand, of the kind I use on my own engines. It is easy to make, and efficient in operation ; here are the details.



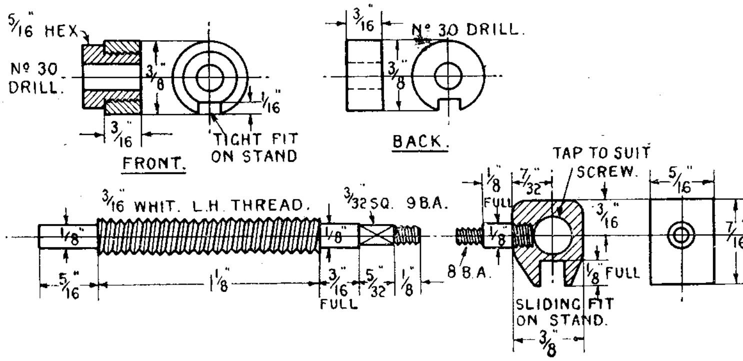
Screw reversing-gear

Stand and Bearings

Maybe our advertisers will be able to supply a cast stand, with bearings for the screw cast on. If they do, you only need clean up with a file, drill the screw-holes and the back bearing, and drill and tap the front bearing as shown for the built-up stand. If the casting is supplied straight, it can be set over as shown in the illustration, as cast bronze or gunmetal bends readily without breaking. If a casting isn't available, or if you prefer to build up, make the stand from a piece of ⅛-in. steel, same stuff as used for frames. A piece 3¾ in. long and 1½ in. wide is needed, and this is cut away at one side as shown. Four No. 30 holes are drilled at the bottom for the bolts attaching the stand to the main frame. For the bearings, chuck a bit of ⅜-in. round bronze or steel rod in three-jaw ; face, centre, drill about ½ in. depth with No. 30 drill, and part off two 3/16-in. slices. Rechuck one of them, open out with 7/32-in. drill, and tap ¼ in. by 40. Both these bearings must have a groove filed or milled along their length, 1/16 in. deep and a tight fit on the top edge of the stand. The tapped one goes at the straight edge of the stand. Put them on, make certain they are dead in line, and then braze if steel, or silver-solder if bronze or gunmetal. Clean up, run the tap through the front again to clear the threads, then make a little screwed bush, same as a piston or spindle gland, from 5/16-in. hexagon brass rod, to fit the tapped bearing. I forgot to mention above, that if the grooves are milled, it is easier to do the job on the piece of rod, before parting off the bearings.

Screw and Nut

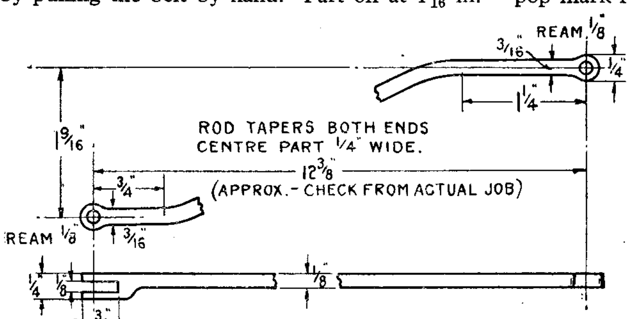
The screw is made from a piece of $\frac{3}{16}$-in. round mild-steel or hard bronze. Chuck in three-jaw, face the end, turn down $\frac{1}{8}$ in. length to 5/64 in. diameter and screw 9-B.A. Turn down a bare $\frac{3}{8}$ in. length to $\frac{1}{8}$ in. diameter; file 5/32 in. of this to a 3/32-in. square, a process I have described umpteen times already, so needn't repeat here. The next stage of the proceedings depends on what screwing-tackle you have available. If you have a tap for $\frac{3}{16}$-in. Whitworth left-hand thread, use it. If not, right-hand will do; in fact, all our Stroudley engines on the L.B. & S.C. Rly. had right-hand screws. If you haven't a Whitworth pitch, a finer one could be used, but it will take a month of Sundays to reverse the engine. Anyway, put your die, whatever it is, in the tailstock holder; pull enough of the steel out of the chuck to cut a full thread $1\frac{1}{8}$ in. long, and get busy. Use plenty of cutting oil, and work the mandrel back and forth by pulling the belt by hand. Part off at $1\frac{7}{16}$ in. from the shoulder. Reverse in chuck—you can hold the thread in the jaws without hurting it, if you don't tighten them too severely—and turn down $\frac{5}{16}$ in. of the end to $\frac{1}{8}$ in. diameter. The threaded part should now be exactly the same length as the distance between the bearings on the stand.



Bearings, screw and nut

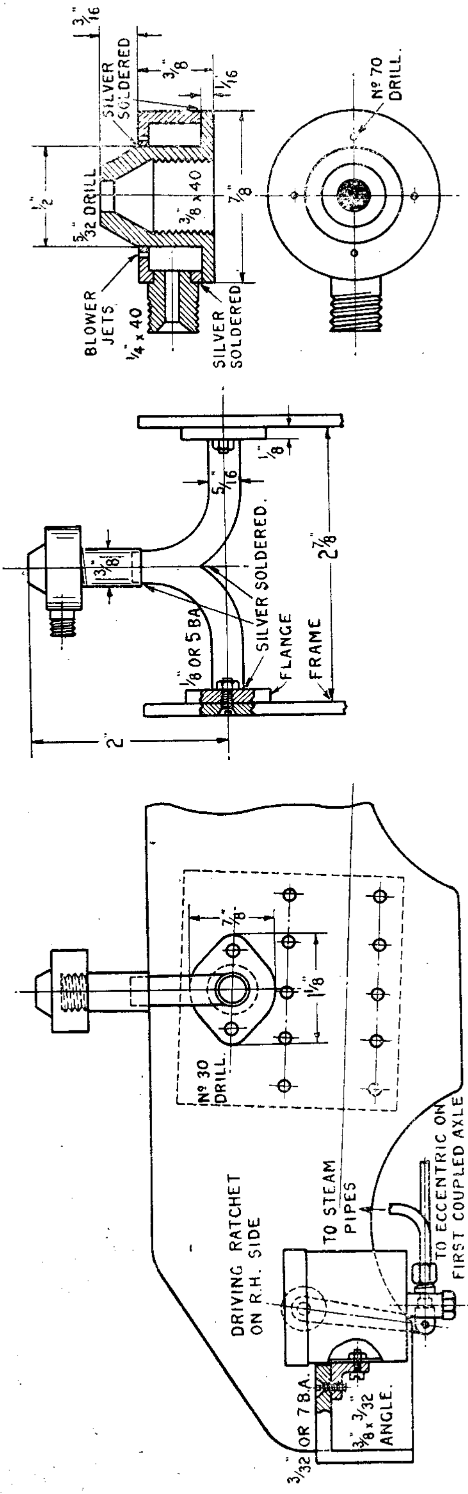
Anybody who has a screw-cutting lathe and knows how to use it, and needs a quick reversing-gear for an up-and-down line, can make the thread two-start. Set up your change wheels to cut 12 threads per inch, and instead of using a screw-cutting tool, put a $\frac{3}{16}$-in. Whitworth chaser in the slide-rest tool holder. Proceed to cut your thread in the manner usually observed among screw-cutting artists, and you'll automatically get a lovely two-start. To make the tap for the nut, repeat the process on a bit of $\frac{3}{16}$-in. silver-steel, taper off the end, file it square for about half the length of the thread, harden and temper to dark yellow. The squared tap will be quite O.K. for the one nut. One of my own engines has a three-start thread, and reverses in four turns of the wheel. I made the screw by setting up the change-wheels for 8 threads per inch, and using the 24-tooth chaser as above, so that it cut three grooves per turn, the chaser advancing three teeth per revolution.

For the nut, part off a piece of $\frac{5}{16}$-in. by $\frac{3}{8}$-in. bronze or gunmetal to a length of $\frac{7}{16}$ in. The hole for the screw is drilled and tapped off-centre $\frac{3}{16}$ in. from the top, and 5/32 in. from one of the longer sides, see section. Make a centre-pop at the correct spot, chuck in four-jaw with this pop-mark running truly, open out with a centre-drill, then with 5/32-in., and tap it to suit the thread on the screw. The groove in the bottom must be exactly under the tapped hole, and a full $\frac{1}{8}$ in. wide and deep, so that it can slide readily on the top edge of the stand. In the wider side of the nut, drill and tap a hole for the reach-rod pin. If you have $\frac{1}{8}$-in. by 60 tap and die, use that; if not, use 5-B.A. The pin is merely a piece of $\frac{1}{8}$-in. silver-steel, one end screwed to fit the tapped hole in the nut, and the other turned down to a bare 3/32 in. diameter, and screwed 8-B.A. The plain part between nut and shoulder should be $\frac{1}{8}$ in. full. Round off the upper edges of the nut, and bevel the sides as shown, for the sake of appearance.



Reach-rod

To assemble, poke the squared end of the screw through the tapped hole in the front bearing; put the nut over the top of the stand, with the reach-rod pin to the left, enter the screw in the nut, and screw through until the plain part at the back of the square is right home in the back bearing. Put the little gland in the front bearing, the hole in same going over the front spigot of the screw, and screw right home. When the gland is tight, the reversing-screw should turn easily



Left.—How to erect lubricator. Right.—Exhaust pipes and blast nozzle

with finger grip only, the nut running easily from one end to the other. A spot of oil helps! If O.K., make and fit the handle; no detailed instructions are needed for that. File it up from a bit of 3/32-in. by $\frac{1}{4}$-in. steel or nickel-bronze strip, drill a No. 48 hole at each end, and turn up two weeny hand-grips from $\frac{1}{8}$-in. rod, leaving a pip on the butt end of each, to fit the holes in the lever. Countersink the holes at the back, and rivet in the grips. Drill a 3/32-in. hole in the middle, file it square to suit the square on the spindle, and secure with a commercial 9-B.A. nut and washer.

To erect the stand, simply clamp in place on the outside of the left-hand frame (the big Class 5's are all left-hand drive) with the back of the stand touching the top of the drag-beam, and the centre of the screw 3 in. above it. Run the No. 30 drill through the holes in bottom of stand, right through the frame, file off any burrs, and put in four $\frac{1}{8}$-in. or 5-B.A. bolts. I have shown hexagon heads, but it doesn't matter a bean what heads you use, as the screws can be put through from inside, and nutted outside, and Inspector Meticulous won't have any excuse for another journey to the " local."

Reach-rod or Reversing-rod

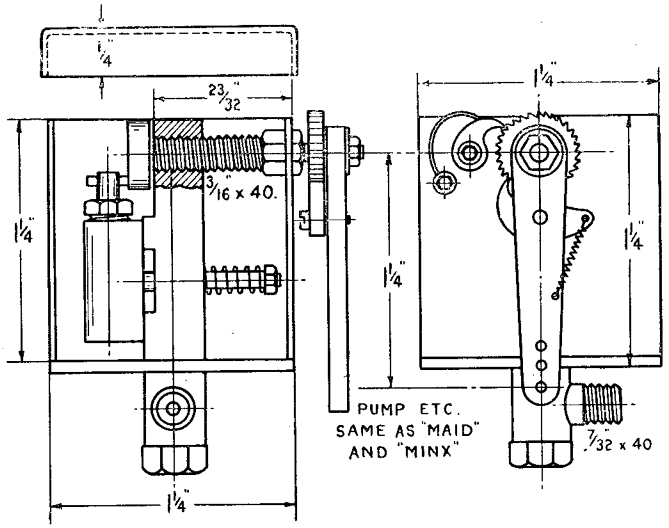
The reach-rod can be made from a length of $\frac{1}{4}$-in. by $\frac{1}{8}$-in. mild-steel rod, with a little block brazed on to machine up into a fork, as described already for valve-gear parts, so I needn't go through that part of the ritual again. The approximate length is $12\frac{3}{8}$ in. between centres; but to get the exact length, measure from the actual job. Put the reversing-nut in mid-travel, and the valve-gear should be set with the die-blocks exactly opposite the link trunnions; then measure from the centre of the hole in the reverse arm, to the centre of the reach-rod pin on the reversing-nut.

Note, the rod starts away level from the reverse-arm on the weighbar shaft, and proceeds thus for $\frac{3}{4}$ in., when it takes a slight bend upwards, and runs up to the level of the reversing-screw; see general arrangement drawing. The last $1\frac{1}{4}$ in. to the eye which goes over the pin on the reversing-nut, are also level, as shown in the separate illustration of the rod given here. The fork is coupled to the reversing-arm by a little bolt made from $\frac{1}{8}$-in. silver-steel, as described for the valve-gear; and the eye end is held on the pin in the reversing-nut by a commercial 8-B.A. nut and washer.

How to Set the Valves

You can now do a spot of valve-setting if you so desire, or can leave it until the steam pipes are on; please yourselves. If the former, jam a short bit of tube into the steam inlet on top of the cylinder, and connect it to a tyre-pump by a piece of rubber tube and a suitable adaptor. Put the valve-gear in mid-position, apply the air pressure, and turn the wheels by hand. When the main crank is just off the dead centre, say about one spoke of the wheels, a sound should come from the hole where the cylinder drain cock will be screwed in, about the intensity of the sigh of a love-sick cockroach; and this should increase to a real sibilant hiss when the crank actually is

on the dead centre. All that constitutes the valve-setting, is to adjust the valve on its spindle, by means of the locknuts, until the effect described above is obtained at each dead centre. The valve-gear itself will look after the rest of the doings. You hear at various functions and meetings what a frightfully specialised job valve-setting is ; well, as a famous strip-cartoon artist would say, believe it or not! With the simple setting described above, young "Doris" will jump off the mark like a scalded cat with normal load, try to blow the chimney clean off the smoke-box when starting an outsize load, and run like a deer with the reversing-nut just off middle, and the exhaust purring like a happy cat. You don't have to take my word for it—see for yourselves later on.



Mechanical lubricator

Exhaust Pipe Assembly

One of the most important essentials for a free-running efficient engine is an unobstructed exhaust. None of my engines has ever suffered from back-pressure trouble, and in the present instance I have gone a step farther and "streamlined" the pipes, as in full-size practice. The holes in the frames, where the exhaust comes through from the recesses in the cylinders, are covered by oval flanges, each carrying a $\frac{5}{16}$-in. copper bend. These are filed half away at their upper ends, and connected by the $\frac{3}{8}$-in. blast-pipe, which is surmounted by a combined blast-nozzle and blower-ring.

The flanges are either cast, or cut from $\frac{1}{8}$-in. brass plate ; don't drill the screw-holes yet, but drill the middle hole a tight fit for the $\frac{5}{16}$-in. pipe. If a piece of $\frac{5}{16}$-in. by 22-gauge copper tube is softened, and filled with lead or sand, it can be bent into a complete half-circle, and the two required bends sawn out of it. The upper halves of these are filed away for half their diameter, butted together, and inserted into the bottom of the blast-pipe. This is just a $\frac{7}{8}$-in. length of $\frac{3}{8}$-in. by 20-gauge copper tube with a few $\frac{3}{8}$-in. by 40-pitch threads on one end. Silver-solder the joints, then cut the two arms to such a length that they will just go between the frames with the blast-pipe central. Carefully drive a flange on to each end, and adjust so that the assembly will just fit between the frames ; then silver-solder the flanges, pickle, wash, and clean up.

If you have already fitted the cylinders, they will have to be temporarily removed to erect the exhaust pipe assembly. At each side of the $\frac{1}{2}$-in. hole in the frame, drill a No. 30 hole, the centre of same being 5/32-in. from the edge of the exhaust hole. Countersink it to take the head of a $\frac{1}{8}$-in. or 5-B.A. countersunk screw. Now put the exhaust assembly in place, and very carefully adjust it for correct position, temporarily clamping it with a toolmaker's cramp each side. Poke the No. 30 drill through the brass flanges *via* the countersunk holes in frame, put brass screws in, and secure with brass nuts. If the frames are the least bit rough, so that steam might escape between flanges and frame, put a bit of very thin paper smeared with plumbers' jointing between flange and frame ; and don't forget, before putting the cylinders back, to cut out the piece covering the hole in the flange and frame, so that the steam can get out. It isn't exactly an unknown occurrence for a big engine to be erected with "blind" gaskets. One morning "back in the days" when our sand wouldn't run on one side, I found that "Sandy" had forgotten to cut a hole in the joint when he put the pipe back after a small repair. If the frames are at all rough on the outside, the same treatment may be given to the cylinders when re-erecting them.

To make the combined blast-and-blower cap, chuck a bit of $\frac{7}{8}$-in. round brass rod in three-jaw. Face, centre, and drill about $\frac{5}{8}$ in. depth with

5/32-in. drill. Turn down ½-in. length to ½ in. diameter; cone the end for 3/16 in. as shown, and part off 9/16 in. from the end. Reverse in chuck, open out with 11/32-in. drill for 5/16 in. depth, and tap 3/8 in. by 40. Chuck the 7/8-in. rod again; centre and drill ½ in. for 3/8 in. depth, then bore out to ¾ in. diameter and ¼ in. depth, either with a square-ended boring-tool or a big D-bit. Part off at 5/16 in. from the end, and drill a 3/16-in. hole in the side. Fit a ¼-in. by 40 union nipple in this, as shown; a kiddy's practice job needing no detailing. Now drop the cup over the centre part, and silver-solder all the joints. I find "Easyflo," in wire form, about the easiest to use for these fittings; simply anoint the joints with wet flux ("Tenacity," No. 3), heat to medium red, and touch each joint with the wire. It only needs the weeniest bit to make a sound joint; and if you pick up the fitting in a small pair of tongs, and just dip in the pickle whilst still hot, every bit of the burnt flux cracks off. I keep a drop of pickle in a 2-lb. jam-jar on a shelf behind my brazing pan for this sort of job. After washing, a touch on a circular wire scratch-brush stuck on the end of the spindle of my grinder (speed 2,900 r.p.m.) brings them up like jewellery; not that this matters for anything going in the smokebox, but very nice for backhead fittings. Finally, drill four No. 70 holes as close to "Mount Vesuvius" as you can, so that the steam will all go up the liner. The cap is not fitted permanently until the smokebox is on.

Mechanical Lubricator

As I have only just described the mechanical lubricator for "Maid of Kent" and "Minx," and this one is exactly similar except for the length of the container—1¼ in. instead of 2 in.—and, consequently, a shorter shaft and bearing (see sectional illustration), there is no need to go over the same ground again. Look up the issue for August 19th, pages 190 and 191, which gives a summary of the construction, and detailed drawings of the stand, pump, and ratchet gear, also a section of the check-valve. The complete lubricator is erected same as described for "Maid of Kent," by a piece of angle attached to the front of the lubricator, by three screws nutted inside the tank, and attached to the underside of the top of the buffer-beam by three more screws, countersunk-headed this time, running through clearing holes in the beam, into tapped holes in the angle, which need be only 1 in. long. The whole arrangement is shown in the drawing of front end of frames and cross section of exhaust pipe assembly.

The ratchet lever is waggled back and forth by a long 1/8-in. rod connected to the lever by a little fork made from 7/32-in. or ¼-in. square steel, same as the forks in the valve-gear. The other end is screwed into the lug of an eccentric-strap, made to fit the eccentric on the first coupled axle, the method of machining being the same as the pump eccentric. The length of the rod is obtained from the actual job; when the eccentric is on top and bottom centre, the ratchet-lever should be exactly vertical, and should click one tooth with every revolution of the wheels. This will supply enough oil to maintain a film between the valve-bobbins and liners, and pistons and cylinder bores, so that the engine should run a very long time before any wear takes place. Next item, cylinder drain-cocks.

Tail Lamp

Here is an afterthought: if anybody would prefer a "pole" lever to a wheel and screw, for operating on an up-and-down line, in the issue mentioned above I described the reversing lever for "Maid" and "Minx." This would be "the cat's whiskers" for "Doris," if made to approximately three-quarters of the given dimensions, and erected in the same position as given for the screw reverser stand.

Locomotive "Pipe Dreams"

I WAS rather amused by "L.B.S.C.'s" recent suggestion that F. C. Hambleton and myself should commit to paper our respective ideas as to what should be the standard British Railways express passenger locomotive of the future. The results might be, not only still more amusing but, what is more to the point, very wide of the mark unless the future policy with regard to the loads, speeds and routes of express passenger trains is known.

At the moment of writing, no official information is available regarding the results of the recent interchanges of express locomotives among the four regions of British Railways; but, from what I can gather from a number of different observers, professional and amateur, the engine which gave consistently good *all-round* performance in all her trials was the rebuilt 4-6-0 "Royal Scot" No. 46166, *Queen's Westminster Rifleman.* This engine seems to have been always well on top of the job, an excellent time-keeper, with plenty of reserve power, and she does not seem to have been heavy on coal. Even so, I am not prepared to accept this as evidence that the rebuilt "Royal Scot" is the engine best suited for the express passenger traffic of British Railways, unless all the conditions are to be so planned as to be everywhere similar to those in which the "Royal Scot" class is used.

The problem is a very "sticky" one, and its solution must be left to those whose job is to solve it. They alone have the necessary information on which to work; but how they got it in eight days (actual) of running by each type of engine, during the recent trials, I am at a loss to explain!

In the meantime, every locomotive enthusiast is free to have his "pipe dreams," the results of which will be interesting to compare with what the Transport Commission produces.—J.N.M.